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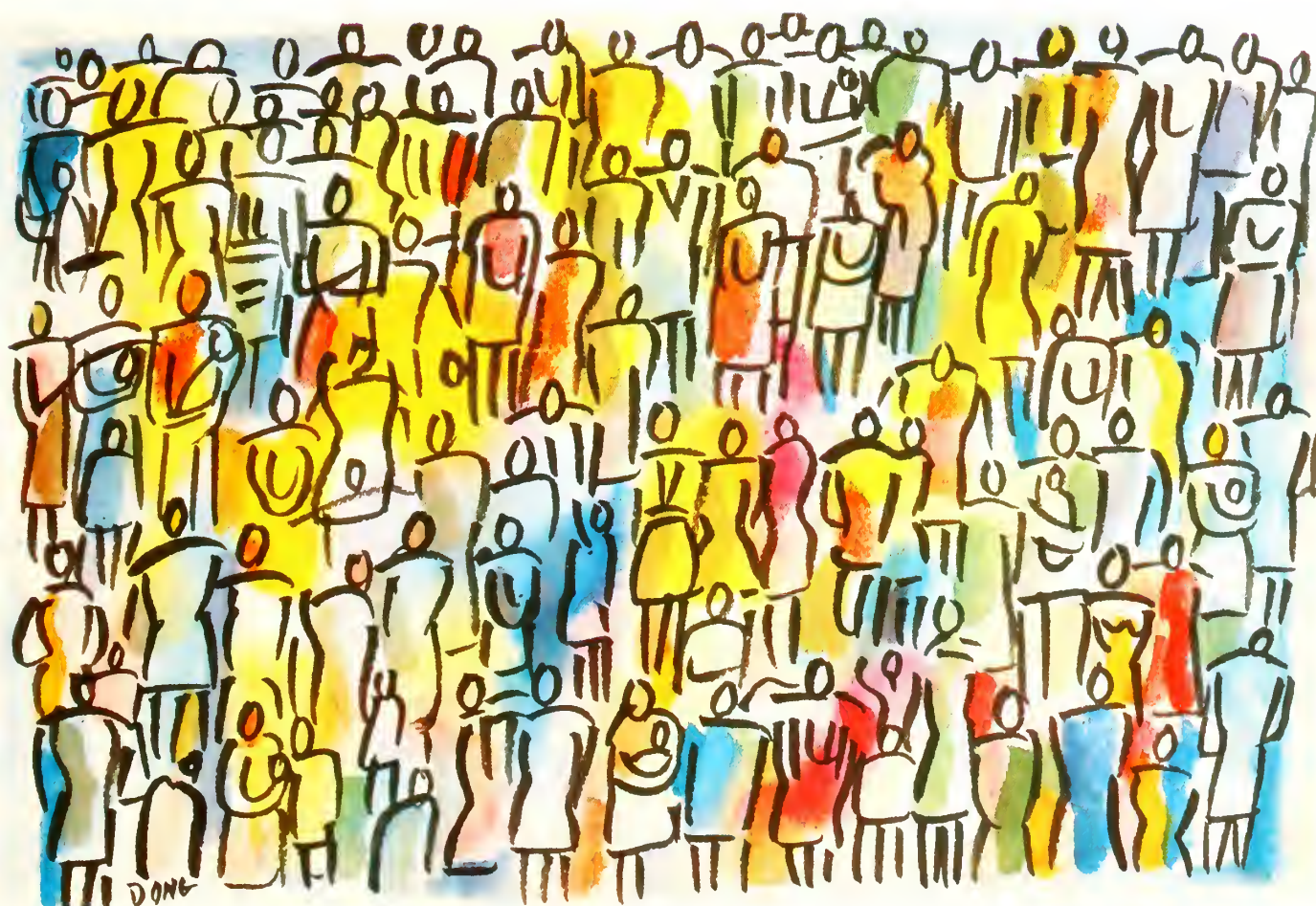


North Carolina

Leading Causes of Death

Expanded Edition

Including 1979-1998 Mortality Trends



**Vital Statistics
Volume 2 – 1998**

Publications of the State Center for Health Statistics

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Cancer Incidence in North Carolina, County-Specific Numbers (Annual):

Observed and expected numbers of newly diagnosed cancer cases for 26 cancer sites and total cancer are provided by county and gender. State and county tabulations of cases by race-sex and age are also provided.

North Carolina Cancer Facts and Figures (Biennial):

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Vital Statistics Volume 2 – 1998

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Introduction

This publication shows death rates for the twenty years of mortality data (1979-1998) coded under the International Classification of Diseases, 9th Revision (ICD-9). Beginning in 1999 causes of death have been coded using the 10th Revision of the ICD. The State Center for Health Statistics produces a major publication annually, describing in tabular and map form North Carolina's mortality experience over the most recent five-year period. Periodically, an expanded volume is produced that includes a narrative analysis for each cause of death. The expanded format is resumed in this 1998 edition, which includes statistical tables, maps, and graphs, as well as discussions of cause-specific trends, geographic patterns, risk factors, and pertinent research. An overview of mortality in North Carolina is also presented.

The tables in this report provide selected mortality statistics for counties and the state. More than a dozen of the leading causes of mortality in North Carolina are tabulated; in addition, four major cancer sites and total infant mortality are included.

Four five-year death rates are presented here for the state and each county: 1979-83, 1984-88, 1989-93, and 1994-98. In keeping with the new convention of the National Center for Health Statistics, all age-adjusted death rates use the projected year 2000 population for the United States as the standard population. As a result, the adjusted rates in this volume will not be comparable to those published in previous editions of *Leading Causes of Death*. A Technical Notes section defines death rates and the methods for age adjustment of death rates. The reader is urged to consult this section prior to using the data in this volume. Also, please refer to the Appendix for a more detailed discussion of age-adjusted death rates.

A more exhaustive breakdown of cause-specific mortality by age, race, and sex is described in the companion volume, *North Carolina Detailed Mortality Statistics*. This and other publications (listed and described on the inside front cover of this publication) are available through the State Center for Health Statistics. If you would like copies of these publications you may contact the Center's Information Services Unit. Many of them are also available online at <http://www.schs.state.nc.us/SCHS/>.

If there are any questions concerning this publication, please contact:

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Organization of this Publication

The first sections of this edition of *Leading Causes of Death* present an overview of mortality in North Carolina and discussions of premature mortality and racial/ethnic differences in mortality. The next sections consist of tabular data, maps, and narrative material which describe North Carolina's recent experience with respect to total mortality and cause-specific mortality. For each cause, risk factors, geographic patterns, differences by race and sex, and trends over time are considered.

A Technical Notes section provides information concerning the calculation, interpretation, and appropriate use of adjusted and unadjusted rates. Readers are cautioned about using rates based on a small number of deaths. Any death rate with a small number of deaths in the numerator will have substantial random variation over time. A good rule of thumb is that any rate based on fewer than 20 events in the numerator may be subject to serious random error. Many of the death rates in this report have numerators smaller than 20, and so extreme caution should be taken when making comparisons or assessing trends.

Appendix A describes the selected cause-of-death categories in terms of codes from the ninth revision of the International Classification of Diseases. Altogether, the major causes selected for examination in this report accounted for 82 percent of all North Carolina deaths during 1998. Data for some of the specific cancer sites listed in Appendix A are not presented at the county-level in this report, due primarily to the relatively small numbers of deaths.

Description of Tables

Except for infant deaths, a table for each cause-of-death category includes the following items of information for the state and each county of residence:

1. The number of resident deaths occurring during 1998;
2. The 1998 death rate;
3. The number of resident deaths occurring during 1994-98;
4. The 1994-98 average annual death rate;
5. The 1979-83, 1984-88, 1989-93, and 1994-98 average annual age-adjusted death rates computed by the direct method, using the projected United States 2000 population as the standard for adjustment.

The formulas for calculating single- and five-year rates are described in the Technical Notes section. In this report, total mortality rates (all causes combined) are expressed as deaths per 1,000 population. Cause-specific rates are expressed as deaths per 100,000 population. The infant death rates of Table 21 are computed as the number of infant deaths per 1,000 live births.

Description of Maps

This publication contains 19 sets of maps which depict data for the state's 100 counties. (See inside of back cover for a map with county names.) For total mortality and each cause of death, the 1994-98 unadjusted death rates and the 1994-98 age-adjusted death rates are mapped. These maps show five levels of death rates. The interval values (levels) indicated by the map legends are not necessarily continuous, but reflect the actual range of values for each interval. These maps must be viewed with caution for causes where the number of deaths per county is small, since in these cases rates can be unstable. A clustering routine from the Statistical Analysis System (SAS) was used to group counties that are "most like each other" with respect to their unadjusted and adjusted rates. This procedure may result in very large or very small groups, depending upon how county rates differ from one another.

Overview of Mortality in North Carolina

Total mortality in North Carolina has exhibited an overall downward trend in this century, but an upward trend since 1982, rising from a low of 8.1 deaths per 1,000 population in 1982 to a high of 9.0 in 1998. Probably the major factor contributing to this increase is aging of the state's population. Other factors that affect mortality include changes in lifestyle (e.g., reduction in smoking), environment, and the medical care system. This overview summarizes four general determinants of mortality as well as some of the risk factors that are associated with a number of different causes. Then premature mortality in North Carolina is examined via the concept of "years of life lost," which emphasizes the impact of mortality in the younger age groups.

Determinants of Mortality

A broad view of mortality determinants shows that problems "arise from causes embedded in the social fabric of the nation as a whole"¹, and that medical care is only one aspect of health maintenance. Accordingly, environment, lifestyle, biology and genetics, and medical care must all be considered as determinants of health.

Over the past decades, *environmental factors*, both natural and man-made, have been increasingly recognized as having a significant impact on health. For example, naturally occurring variations such as water mineral content and elevation have been cited as influencing the incidence of cardiovascular disease². Another problem may be the natural occurrence of radon gas in some homes. However, most serious environmental problems are consequences of man-made pollution of air^{3,4}, water, and food sources. Recent examples include atmospheric pollution from lead and ozone, ground water contamination from toxic wastes, and occupational exposures to hazardous substances. Children are especially at risk from pollutants such as ozone^{5,6} and lead.^{7,8}

While pollution is a by-product of a high-technology, growth-oriented society, some favorable consequences of economic growth include jobs, income, health insurance, and improved access to medical care. Unemployment and poverty are generally associated with less adequate mental and physical health. The poor, having fewer economic and social resources, experience higher levels of stress and are more vulnerable to infectious agents, economic problems, and hazards in the home and workplace. Rural populations are less likely to have medical insurance and good access to medical care. In short, economic conditions and environmental factors may interact in complex ways to affect health status.

Lifestyle refers to behaviors that affect health and over which individuals have varying degrees of control. There are substantial data showing that certain health habits (e.g., never having smoked, moderate or no alcohol consumption, regular exercise, sleeping 7-8 hours per night, and maintaining appropriate weight) are associated with improved health and reduced mortality.^{9,10} Individuals' lifestyle decisions are associated with their socioeconomic status, race, and sex. Men are more likely than women to smoke and drink excessively; younger women are more likely to smoke than older women; blacks are more likely to be sedentary than whites; and black women are substantially overweight almost twice as often as white women. Persons with fewer than 12 years of education are more likely to smoke, not exercise, and be substantially overweight.⁹ Individuals' lifestyle decisions are significantly influenced by their demographic characteristics and socioeconomic status. "Blaming the victim" by keeping the problem only at the individual level may obscure some of the origins of disease in the socioeconomic environment. Policies to educate individuals about their health behaviors are less complex and easier to sell politically than those aimed at modifying the underlying social and economic determinants of lifestyle and health.

Health education of individuals is an important component in improving health. Certain population groups are more likely to have lifestyles associated with increased mortality, and education programs are effective complements to policies oriented toward the environmental factors that condition lifestyle. For example, nutrition education can have a substantial health payoff among the poor, but the payoff will be much higher if they have sufficient money to buy proper foods and facilities for preparation. Sex education for prevention of sexually transmitted diseases and unwanted pregnancies is another area where education may be very effective in altering specific high-risk behaviors. Income, education, and urban/rural residence are important indicators and determinants of lifestyle,¹¹ and effective education programs must consider these factors. Targeting specific high-risk groups is likely to be more successful than generalized education or media campaigns.

Biological factors are powerful determinants of mortality. The age, race, and sex of an individual are biologically determined, and mortality rates vary consistently along these dimensions. For example, health is strongly tied to aging and the life cycle. Some diseases that vary by race are thought to be genetically linked. Biological factors in part account for the higher rate of some diseases in men as compared to women, with women living longer on the average. However, there are health consequences of age, race, and sex that are not biological in origin. Social stratification is partly based on these variables, with the elderly, minorities, and females generally being accorded lower socioeconomic status in the United States. Some of the elevated male mortality may result from the aggressive, achievement-oriented lifestyle that accompanies higher status positions,¹² while higher mortality among persons of racial and ethnic minorities is due in part to a lower position in the economic hierarchy.¹³

A number of diseases are directly or indirectly genetic in origin. In North Carolina, many people are afflicted with serious genetic disorders, resulting in physical defects, mental retardation, and other health problems, and a significant percentage of birth defects are genetic in origin.¹⁴ It has been estimated that 12 percent of pediatric hospitalizations are related to birth defects and genetic diseases,¹⁵ and about 50 percent of all childhood blindness is linked to genetic factors.¹⁶ In North Carolina, congenital malformations are a leading cause of mortality among infants under one year, and second only to injuries among children ages one through four. Overall, the 1998 congenital anomalies death rate was 5.1 deaths per 100,000 population. This is only a slight decline from a rate of 5.3 in 1988. In addition, some persons have a genetic susceptibility to certain diseases. Many types of cancer, for example, have genetic origins.¹⁷

The *medical care* system is another important determinant of mortality levels. It responds to health problems by attempting to restore the individual to a full and productive life. Disease prevention is also within the purview of the medical care system, as exemplified by vaccination to prevent infectious diseases and by patient education concerning health consequences of certain behaviors. Medical care personnel may also be involved in addressing certain environmental causes of disease, though this type of activity has traditionally been carried out by the public health sector.

McKeown and Brown¹⁸ present evidence suggesting that medical practice in the first half of the 19th century had little to do with the large decline in mortality that took place in Western societies. They suggest that transportation improvements, changes in the economic system that assured a more continuous and nutritious food supply, and improved sanitation practices in the cities were responsible. After the practice of antisepsis became widespread late in the 19th century, medical care became a much more positive factor in reducing mortality. During the first half of this century, the health and average life span of Americans improved considerably, due substantially to efforts in the medical sector to reduce infections and acute nutritional diseases. Major gains were also observed in infant and maternal mortality, probably due to improvements in nutrition, sanitation, and the development of vaccines.¹⁹

Medical care may sometimes have negative health consequences. It has been estimated that infections acquired inside the hospital strike five percent of Americans hospitalized each year, adding to hospital costs and increasing lengths of stay.^{20,21,22} Inappropriate or unnecessary treatment may increase mortality as well as health care costs. Risks are always present, even in proper medical treatment, but in most cases they are far outweighed by the potential benefits.

In summary, a complete program to improve health status and reduce mortality must include environmental, lifestyle, biological, and medical care strategies. Too much emphasis in one area may involve substantial opportunity costs due to neglect of other areas. For example, expenditures for basic research, for environmental protection, to improve substandard housing, or for public education regarding specific risk behaviors could have higher long-term health payoffs than would the same amount expended just for medical care. The status of heart disease and cancer as major killers is closely linked to lifestyle and environmental factors. Sedentary occupations and consumption of foods high in animal fats contribute to both heart disease and cancer. Increased economic production and consumption have led to more exposure of the population to carcinogens in air, water, and food. Effective cancer control will require fundamental changes in the environment as well as modification of behaviors and lifestyle. In short, strategies to reduce cancer, heart disease, and other leading causes of mortality must deal with factors in the fabric of contemporary society.

Risk Factors

Risk factors particular to each cause of death are discussed in separate sections of this volume. Information about several factors that are common to a number of different causes of death is summarized here.

Two of the most pervasive factors contributing to mortality from various diseases are *high blood pressure* and *cigarette smoking*. Elevated blood pressure is associated with death from all cardiovascular diseases, diabetes mellitus, cirrhosis of the liver,^{23,24} and renal failure.²⁵ While most causes of hypertension are amenable to treatment, many people either are unaware of having the condition or do not modify behaviors to control it (e.g., maintain proper weight, diet, and medication regimen).

Use of *tobacco products* contributes to death from a large number of causes.^{23,24,26-29,30} According to data compiled by the U.S. Surgeon General,²⁹ cigarette smoking is a major cause of lung cancer as well as cancers of the larynx, oral cavity, and esophagus; it is a contributory factor in the development of cancers of the bladder, pancreas, and kidney; and approximately 30 percent of all cancer deaths are attributable to cigarette smoking. There is evidence that it is a contributor in the development of chronic bronchitis and emphysema, pulmonary heart disease, myocardial infarction, aortic aneurysm, and a wide variety of other vascular diseases. In addition, smoking seems to interact with other risk factors, such as asbestos, ionizing radiation, oral contraceptives, and certain dietary factors, to produce a variety of cancers and vascular diseases. Use of smokeless tobacco (snuff, chewing tobacco, and similar products) is associated with tongue cancer and oral cancers in general.^{31,32} There is also substantial evidence that environmental tobacco smoke (passive smoking) is associated with increased mortality.³³

Diet has an important impact on certain causes of mortality. Overeating may lead to obesity, which is associated with high blood pressure, diabetes, cardiovascular disease, and overall mortality.^{34,35,36} In turn, diabetes is a risk factor for stroke and other cardiovascular diseases. In addition, the content of the modern diet has important consequences for mortality. The contemporary diet "...is

higher in intake of energy, of protein (especially animal protein), and of fat (especially animal fat), but lower in intake of fiber-containing cereal foods; this diet is associated with high rates of morbidity and mortality from degenerative diseases".³⁷ Decreased intake of animal fat and protein, cholesterol, salt, sugar, and alcohol are often recommended. In addition, inadequate nutrition, irrespective of obesity, is associated with a higher risk of certain diseases.^{38,39}

Excessive alcohol consumption is a very large health problem in America⁴⁰ and is associated with a high risk of premature death from a variety of diseases.⁴¹⁻⁴³ "While the lifestyle typical of many heavy drinkers contributes to this risk, the effects of alcohol *per se* account for a substantial part of the excess mortality".⁴¹ In two Chicago studies, heavy drinkers had higher mortality from all causes, cardiovascular diseases, coronary heart disease, and sudden death than could be entirely explained by other risk factors such as blood pressure, smoking, and weight.⁴² Heavy alcohol use by pregnant women leads to birth anomalies, including fetal alcohol syndrome and subsequent mental retardation.^{40,44} Alcohol consumption increases the risk of mortality from homicide, suicide, and unintentional injury.⁴³

Socioeconomic status has a very strong impact on mortality.^{13,27,45-47} "Social class gradients of mortality and life expectancy have been observed for centuries, and a vast body of evidence has shown consistently that those in the lower classes have higher mortality, morbidity, and disability rates".¹³ Differences between white and minority mortality rates can be attributed largely to the lower average socioeconomic status of minorities. Minorities are more likely to live in substandard housing and other hazardous conditions, resulting in an array of disease consequences. Low education contributes to poor health practices, and low income affects many aspects of health, including nutrition. Higher stress levels and ineffective responses to stress also contribute to higher mortality among the poor.¹³

Persons of lower socioeconomic status generally receive less adequate medical care, though this probably does not account for a major portion of the socioeconomic differences in morbidity and mortality.¹³ In fact, the association between excess mortality and low socioeconomic status persists independent of individual behaviors or attributes such as smoking, alcohol consumption, body mass index, physical activity, marital status, race, and sex.⁴⁸ Properties of the socioeconomic environment are important contributors to the excess mortality.⁴⁹

Social isolation is associated with an increased risk of mortality. Persons with strong social support and social networks have lower mortality risk, independent of other risk factors.⁵⁰⁻⁵³ Married persons have a significantly lower risk of mortality than those who are divorced, single, separated, or widowed, though this relationship may be due to factors besides protective effects of marriage itself.^{54,55}

Sex is another important variable associated with mortality. Females have lower mortality rates and greater life expectancies than males in all developed countries.⁵⁶ The differential in death rates is present at conception and continues for every age group. At birth, the ratio of males to females is 104:100, but by age 70 females outnumber males by approximately 3:2.

A substantial amount of excess male mortality is related to sex differences in behavior, such as cigarette smoking, drinking alcohol, aggressive competitiveness, and occupational exposure to environmental and physical hazards.¹² For 15-44 year-olds, more than 90 percent of the excess male mortality may be attributable to violence and smoking.⁵⁶ Biological factors also contribute to higher male mortality. "Thus, even among nonsmokers, men have higher mortality than women for certain types of cancer, and this implies that there must be other factors, in addition to smoking, that contribute to higher cancer among men".⁵⁶

To the extent that the sex difference in mortality is not due to biological factors, substantial reductions in male excess mortality may be possible through lifestyle and behavioral changes. With the transition earlier in this century from infectious to degenerative diseases as the major causes of death, lifestyle became more important in affecting mortality experience, and the difference between male and female mortality rates increased steadily. More recently, female mortality relative to male mortality has actually worsened for several age groups and for several leading causes.⁵⁷ This may be associated with increased smoking²⁶ and the adoption of other "male" behaviors by women as job participation and mobility increase and traditional roles are modified. Thus, social and lifestyle changes may also help to reduce female mortality.

A number of risk factors have been reviewed that bear on many causes of death, and efforts to reduce mortality must involve consideration of these important precursors.

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Premature Mortality in North Carolina

Since 1914, when deaths were first centrally recorded in North Carolina, the leading causes of mortality have usually been ranked according to number of deaths. North Carolina deaths in 1998 have been ranked in Table A based on this traditional method. As shown, heart disease and cancer are the leading causes of death, followed by stroke (cerebrovascular disease) and unintentional injuries.

Rankings based only on number of deaths (or rate per 100,000 population), however, do not necessarily indicate where medical and public health intervention strategies can be most effectively employed. Since death is postponable but not preventable, age at death is a key factor to consider. Prevention of a death that would otherwise occur early in life could be assigned higher priority than prevention of a death later in life. A convenient method of ranking causes of death that incorporates age at death is by "years of life lost".¹ If the average life expectancy at birth for white males, for example, is 72 years, a death at age 65 would mean seven years of life lost (on the average), while a death at age 40 would mean 32 years of life lost. A white male infant death results in 72 years of life lost, whereas deaths at ages 72 and over do not contribute to years of life lost for white males. Based on the 1989-91 life tables for North Carolina,² the life expectancies used here to calculate years of life lost were 72 for white males, 79 for white females, 65 for minority males, and 75 for minority females. For each death in a given cause group, age at death was subtracted from the appropriate life expectancy and all of these life-years lost were then summed across the four race-sex groups. Deaths at ages greater than the specified life expectancies were not counted.

Table B displays the leading causes of death in 1998 ranked according to years of life lost. Heart disease and cancer are still very important causes of death from this perspective, but other causes become much more prominent than before. Unintentional injuries (motor vehicle injuries and other unintentional injuries) rank much higher in terms of years of life lost. Motor vehicle injury decedents are on average about 28 years younger than heart disease decedents. Likewise, cancer decedents are on average several years younger than heart disease decedents.

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TABLE A:
1998 Leading Causes of Death for North Carolina Residents
Ranked by Number of Deaths

Rank	Cause of Death	Number of Deaths
1	Heart Disease	19,441
2	Cancer	15,327
3	Cerebrovascular Disease	5,434
4	Chronic Obstructive Pulmonary Disease	3,200
5	Pneumonia & Influenza	2,688
6	Diabetes Mellitus	1,963
7	Motor Vehicle Injuries	1,632
8	Other Unintentional Injuries	1,586
9	Suicide	846
10	Septicemia	789
11	Nephritis, Nephrotic Syndrome & Nephrosis	702
12	Chronic Liver Disease & Cirrhosis	699
13	Homicide	664
14	AIDS	432
15	Atherosclerosis	395
Total Number of Deaths from All Causes		67,798

TABLE B:
1998 Leading Causes of Death for North Carolina Residents
Ranked by Years of Life Lost

Rank	Cause of Death	Estimated Years of Life Lost
1	Cancer	120,810
2	Heart Disease	94,058
3	Motor Vehicle Injuries	54,532
4	Other Unintentional Injuries	27,983
5	Homicide	24,324
6	Suicide	23,569
7	Cerebrovascular Disease	20,245
8	Chronic Obstructive Pulmonary Disease	14,224
9	Diabetes Mellitus	13,144
10	AIDS	12,525
11	Pneumonia & Influenza	9,637
12	Chronic Liver Disease & Cirrhosis	9,393
13	Septicemia	5,488
14	Nephritis, Nephrotic Syndrome & Nephrosis	2,310
15	Atherosclerosis	709
Total Years of Life Lost Due to All Causes		573,366

Racial and Ethnic Differences in Mortality

Graphs of trends in age-adjusted death rates for whites and minorities are included in each cause-of-death section. These graphs show single-year age-adjusted death rates for the years 1979 through 1998. These graphs will help identify causes of death where there are large racial disparities in mortality and portray changes in the patterns over time. The county-level mortality data in this publication are not broken out by race, in part for statistical reasons. Many counties have a very small minority population and the number of deaths, even for a five-year period, would be too small to produce reliable age-adjusted death rates for specific causes of death.

There are advantages of showing mortality data by race, to target resources and interventions toward populations most in need. However, hazards exist in interpreting the data. Race in and of itself does not generally cause poor health status. We do not have a complete understanding of why race is associated with health problems, but it is likely that factors such as socioeconomic status, stress, and racism are among the underlying causes of the higher mortality of minorities (on average) compared to whites. Few of our health data have these types of information recorded, while most do have information on race. Thus, race often serves as a surrogate measure for a variety of other factors. Still, there is wide interest in North Carolina in descriptive health statistics broken out by race.

The State Center for Health Statistics normally publishes data by race for only two groups: white and minority. We do recognize and appreciate the various population groups in North Carolina and the need for more details on race, such as for American Indians and Asians. Several factors have hampered efforts to obtain accurate data for specific minority populations. In addition to the issue of small numbers leading to unreliable rates, there are other technical reasons why we usually show data for only the two race groups. First, detailed census data on race is collected only once every ten years. The racial structure of North Carolina's population can change dramatically over the course of a decade. Therefore, as years pass after the latest census, it is more difficult to extrapolate accurate population figures. Second, the State Center relies on annual population estimates supplied by the North Carolina Office of State Planning. They produce official annual population estimates only for "white" and "other." For this reason, the appropriate denominators to produce rates for specific racial groups are not routinely available.

A similar problem exists when attempting to study mortality rates by Hispanicity. The Hispanic/Latino population is an ethnic group, rather than a racial group, and Hispanics may be counted in both white and minority racial groups in our death files. In addition, as with racial groups, there are significant challenges in collecting accurate population data for Hispanics. Over the course of the last decade North Carolina has experienced a dramatic increase in its Hispanic/Latino population. However, population data for Hispanics/Latinos are based on the 1990 census and it is likely that these are underestimates of the true population.

In an effort to address these concerns, the State Center plans to develop its own estimates of the population of specific racial and ethnic groups. A special study is planned which will examine racial and ethnic differences in mortality in greater detail.

In addition to the trend graphs of white and minority age-adjusted death rates shown in each cause-of-death section, two tables are included here that portray state-level differences in cause-specific mortality by race and race-sex for the period 1994-1998 (Tables C and D). These tables show numbers of deaths and age-adjusted death rates for whites and minorities and for white males, white females, minority males, and minority females. In North Carolina, approximately 90 percent of the minority population is African American, so the data for minorities in this publication will closely reflect the experience of African Americans.

TABLE C:
Race-Sex-Specific Age-Adjusted Mortality Rates*
North Carolina Residents, 1994-98

Causes of Death:	White Males		White Females		Minority Males		Minority Females	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate
Total Deaths — All Causes	125,556	1119.0	123,940	708.2	41,011	1592.0	37,377	933.2
Heart Disease	38,530	352.0	37,773	210.5	10,236	433.8	10,623	271.4
Cerebrovascular Disease	7,553	75.7	12,396	68.7	2,721	120.4	3,684	94.1
Atherosclerosis	555	5.8	1,030	5.6	177	9.2	269	6.9
Cancer	31,349	262.8	27,002	158.5	9,185	382.6	7,558	192.1
Lip, Oral Cavity, & Pharynx	518	4.1	321	1.8	256	9.1	74	1.9
Stomach	615	5.3	487	2.8	301	13.0	247	6.3
Colon, Rectum, & Anus	2,850	24.4	2,941	16.9	742	31.7	985	25.2
Liver	639	5.2	416	2.4	174	6.6	109	2.8
Pancreas	1,385	11.5	1,444	8.3	452	18.6	505	13.0
Larynx	280	2.3	71	0.4	158	6.0	21	0.5
Trachea, Bronchus, & Lung	12,016	96.1	6,668	39.0	2,935	117.7	1,168	29.9
Malignant Melanoma	579	4.7	391	2.4	11	0.4	28	0.7
Female Breast	n/a	n/a	4,345	26.3	n/a	n/a	1,480	37.4
Cervix Uteri	n/a	n/a	418	2.6	n/a	n/a	267	6.6
Ovary & Other Uterine Adnexa	n/a	n/a	1,477	8.7	n/a	n/a	302	7.7
Prostate	3,216	32.5	n/a	n/a	1,766	85.7	n/a	n/a
Bladder	762	7.0	364	2.0	122	5.5	98	2.5
Brain Tumors	830	6.3	763	4.7	90	2.9	110	2.7
Non-Hodgkins Lymphoma	1,210	10.0	1,218	7.0	210	7.8	177	4.4
Leukemia	1,217	10.4	937	5.5	248	9.3	231	5.7
AIDS	1,044	7.3	102	0.7	1,915	50.3	663	14.3
Septicemia	935	8.9	1,369	7.7	464	19.6	604	15.2
Diabetes Mellitus	2,663	22.8	2,935	16.8	1,269	51.2	2,089	53.5
Pneumonia & Influenza	4,472	47.9	5,571	30.8	1,208	55.1	1,058	26.8
COPD	6,922	62.4	6,018	34.1	1,204	54.7	678	17.1
Chronic Liver Disease & Cirrhosis	1,639	12.3	892	5.4	586	19.0	312	7.7
Nephritis & Nephrosis	1,103	11.0	1,158	6.5	524	23.7	627	16.1
Unintentional Motor Vehicle Injuries	3,568	26.3	1,918	13.1	1,452	37.5	669	14.3
All Other Unintentional Injuries	3,471	29.1	2,216	13.1	1,305	41.2	586	13.9
Suicide	3,050	22.5	797	5.5	511	12.9	88	1.9
Homicide	1,055	7.4	401	2.8	1,605	37.5	444	9.1

* Using a U.S. 2000 Population Standard. All rates are per 100,000 Population.

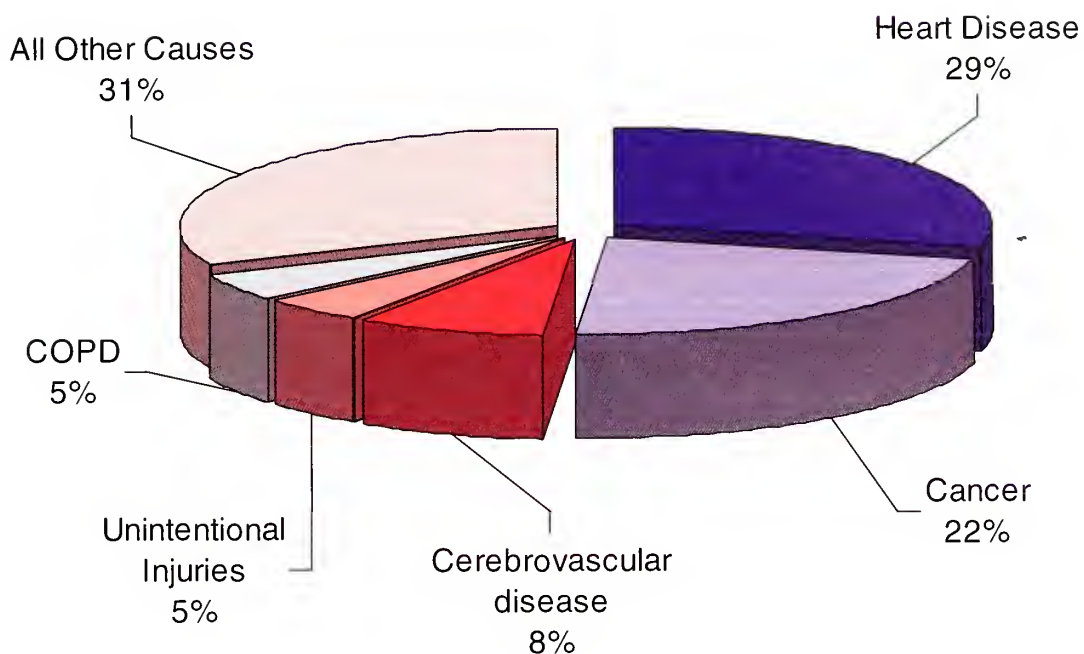
TABLE D:
Age-Adjusted Mortality Rates* by Race and Sex
North Carolina Residents, 1994-98

Causes of Death:	White		Minority		Males		Females		Overall	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
Total Deaths — All Causes	249,496	877.5	78,388	1192.8	166,567	1205.4	161,317	755.5	327,884	940.3
Heart Disease	76,303	269.8	20,859	335.3	48,766	366.1	48,396	222.5	97,162	282.0
Cerebrovascular Disease	19,949	72.0	6,405	104.9	10,274	83.1	16,080	73.6	26,354	78.0
Atherosclerosis	1,585	5.8	446	7.7	732	6.4	1,299	5.8	2,031	6.1
Cancer	58,351	198.6	16,743	261.6	40,534	282.8	34,560	165.2	75,094	210.1
Lip, Oral Cavity, & Pharynx	839	2.9	330	4.9	774	5.0	395	1.9	1,169	3.3
Stomach	1,102	3.8	548	8.7	916	6.5	734	3.4	1,650	4.7
Colon, Rectum, & Anus	5,791	20.0	1,727	27.5	3,592	25.6	3,926	18.5	7,518	21.3
Liver	1,055	3.6	283	4.3	813	5.5	525	2.5	1,338	3.7
Pancreas	2,829	9.6	957	15.2	1,837	12.7	1,949	9.1	3,786	10.6
Larynx	351	1.2	179	2.7	438	2.9	92	0.4	530	1.5
Trachea, Bronchus, & Lung	18,684	62.3	4,103	63.7	14,951	99.8	7,836	37.4	22,787	62.6
Malignant Melanoma	970	3.3	39	0.6	590	3.9	419	2.1	1,009	2.8
Female Breast	4,345	26.3	1,480	37.4	n/a	n/a	5,825	28.6	5,825	28.6
Cervix Uteri	418	2.6	267	6.6	n/a	n/a	685	3.4	685	3.4
Ovary & Other Uterine Adnexa	1,477	8.7	302	7.7	n/a	n/a	1,779	8.5	1,779	8.5
Prostate	3,216	32.5	1,766	85.7	4,982	41.0	n/a	n/a	4,982	41.0
Bladder	1,126	3.9	220	3.6	884	6.8	462	2.1	1,346	3.9
Brain Tumors	1,593	5.4	200	2.8	920	5.7	873	4.3	1,793	4.9
Non-Hodgkins Lymphoma	2,428	8.3	387	5.8	1,420	9.7	1,395	6.6	2,815	7.9
Leukemia	2,154	7.4	479	7.1	1,465	10.3	1,168	5.6	2,633	7.4
AIDS	1,146	4.0	2,578	30.6	2,959	16.4	765	4.0	3,724	10.1
Septicemia	2,304	8.2	1,068	16.8	1,399	10.8	1,973	9.2	3,372	9.8
Diabetes Mellitus	5,598	19.3	3,358	53.1	3,932	27.6	5,024	23.6	8,956	25.3
Pneumonia & Influenza	10,043	36.6	2,266	37.0	5,680	49.2	6,629	30.2	12,309	36.8
COPD	12,940	44.2	1,882	30.1	8,126	61.3	6,696	31.1	14,822	41.9
Chronic Liver Disease & Cirrhosis	2,531	8.6	898	12.6	2,225	13.6	1,204	5.9	3,429	9.5
Nephritis & Nephrosis	2,261	8.1	1,151	18.9	1,627	13.2	1,785	8.2	3,412	10.0
Unintentional Motor Vehicle Injuries	5,486	19.4	2,121	24.6	5,020	28.6	2,587	13.4	7,607	20.6
All Other Unintentional Injuries	5,687	20.4	1,891	25.4	4,776	31.5	2,802	13.4	7,578	21.5
Suicide	3,847	13.4	599	6.8	3,561	20.7	885	4.6	4,446	12.0
Homicide	1,456	5.1	2,049	22.3	2,660	14.3	845	4.4	3,505	9.3

* Using a U.S. 2000 Population Standard. All rates are per 100,000 Population.

NORTH CAROLINA'S LEADING CAUSES OF DEATH

**Figure A: NC Resident Deaths by
Five Leading Causes, 1998**



**Figure B: NC Resident Deaths by
Five Leading Causes, 1978**

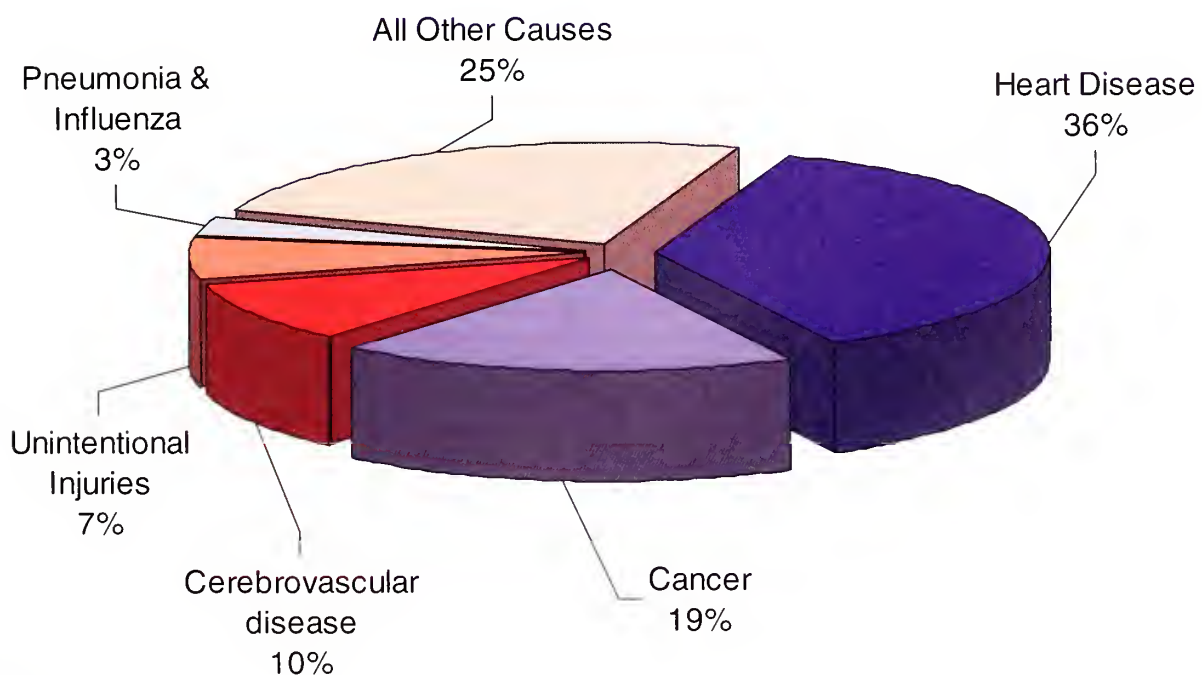


Figure C: NC Resident Deaths by Five Leading Causes, 1958

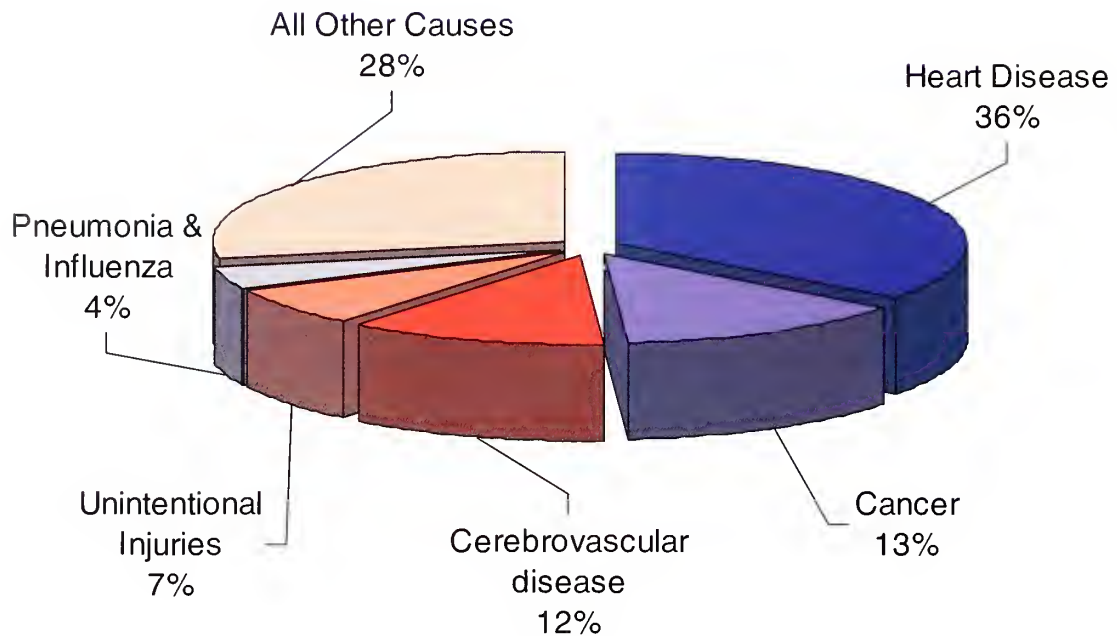


Figure D: NC Resident Deaths by Five Leading Causes, 1938

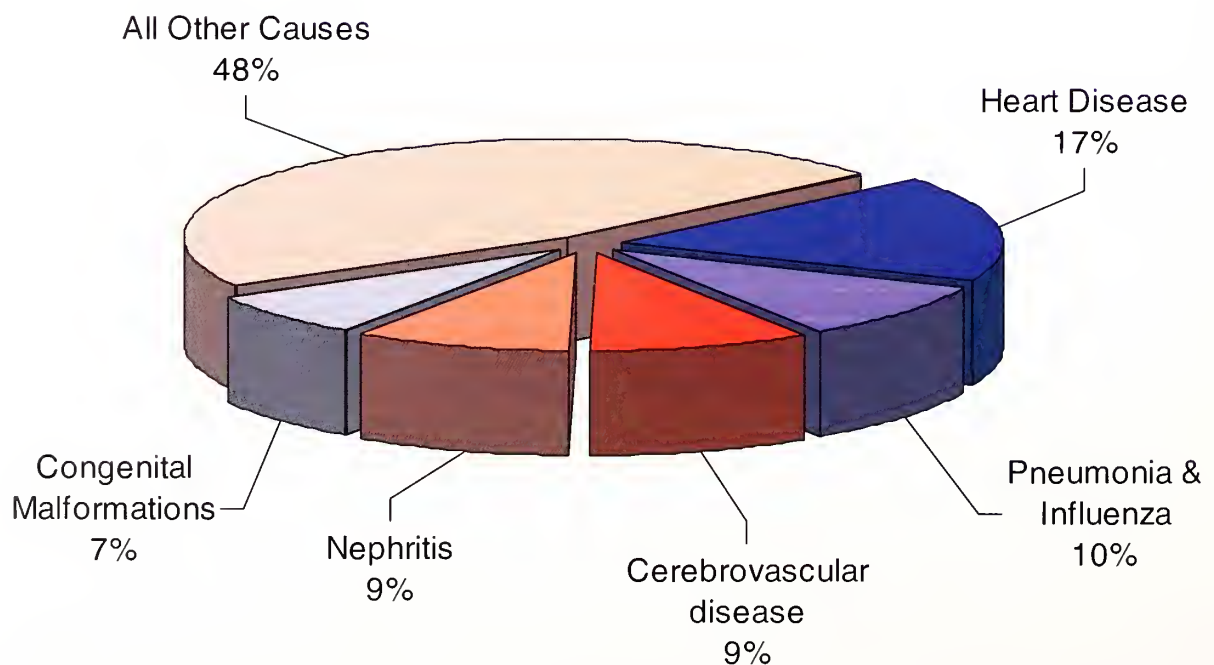


TABLE E:
Leading Causes of Death* by Age Group
North Carolina Residents, 1998

ALL AGES

Rank	Cause	Number
1	Heart disease	19,441
2	Cancer	15,327
3	Cerebrovascular disease	5,434
4	Chronic obstructive pulmonary disease ...	3,200
5	Pneumonia & influenza	2,688
6	Diabetes mellitus	1,963
7	Motor vehicle injuries	1,632
8	Other unintentional injuries	1,586
9	Suicide	846
10	Septicemia	789
	All other causes (Residual)	14,892
Total Deaths - All Causes		67,798

INFANTS (AGE <1)

Rank	Cause	Number
1	Conditions originating in perinatal period ...	563
2	Congenital anomalies (birth defects)	196
3	Symptoms/signs & ill-defined conditions	113
4	Other diseases of the nervous system	18
5	Other unintentional injuries	15
6	Pneumonia/influenza	11
	Septicemia	11
8	All other respiratory system diseases	10
	Homicide	10
10	Motor vehicle injuries	9
	All other causes (Residual)	81
Total Deaths - All Causes		1,037

1 - 4 YEARS

Rank	Cause	Number
1	Motor vehicle injuries	22
2	Congenital anomalies (birth defects)	19
3	Other unintentional injuries	16
4	Heart disease	11
5	Homicide	10
	Cancer	10
7	Conditions originating in perinatal period	6
	Septicemia	6
9	Pneumonia & influenza	3
	Symptoms/signs & ill-defined conditions	3
	All other causes (Residual)	33
Total Deaths - All Causes		139

5 -14 YEARS

Rank	Cause	Number
1	Motor vehicle injuries	68
2	Other unintentional injuries	46
3	Cancer	26
4	Heart disease	13
	Suicide	13
6	Homicide	9
7	Congenital anomalies (birth defects)	8
8	Symptoms/signs & ill-defined conditions	7
9	Pneumonia & influenza	5
10	Anemias	4
	Chronic obstructive pulmonary disease	4
	All other causes (Residual)	52
Total Deaths - All Causes		255

*Leading causes of death are generated from a list of 43 causes of death categories developed by the National Center for Health Statistics to promote comparability in analyses of mortality. For deaths under one year of age, a list of 27 causes of death was used. See Appendices for the ICD-9 codes for these lists of causes.

TABLE E: (cont.)
Leading Causes of Death* by Age Group
North Carolina Residents, 1998

15 - 24 YEARS

Rank	Cause	Number
1	Motor vehicle injuries	385
2	Homicide & legal intervention	163
3	Other unintentional injuries	106
4	Suicide	87
5	Cancer	31
6	Heart disease	27
7	Symptoms/signs & ill-defined conditions	22
8	Congenital anomalies (birth defects)	13
9	Cerebrovascular disease	12
10	Chronic obstructive pulmonary disease	11
	All other causes (Residual)	91
Total Deaths - All Causes		948

25 - 44 YEARS

Rank	Cause	Number
1	Cancer	656
2	Heart disease	578
3	Motor vehicle injuries	554
4	Suicide	351
5	Homicide & legal intervention	348
6	Other unintentional injuries	341
7	HIV/AIDS	298
8	Cerebrovascular disease	127
9	Chronic liver disease/cirrhosis	95
10	Diabetes mellitus	77
	All other causes (Residual)	763
Total Deaths - All Causes		4,188

45 - 64 YEARS

Rank	Cause	Number
1	Cancer	4,068
2	Heart disease	3,291
3	Cerebrovascular disease	607
4	Diabetes mellitus	482
5	Chronic obstructive pulmonary disease	428
6	Motor vehicle injuries	313
7	Chronic liver disease/cirrhosis	295
8	Other unintentional injuries	258
9	Suicide	238
10	Pneumonia & influenza	227
	All other causes (Residual)	2,014
Total Deaths - All Causes		12,221

AGES 65 & OVER

Rank	Cause	Number
1	Heart disease	15,498
2	Cancer	10,533
3	Cerebrovascular disease	4,678
4	Chronic obstructive pulmonary disease ...	2,727
5	Pneumonia & influenza	2,362
6	Diabetes mellitus	1,398
7	Other unintentional injuries	804
8	Other diseases of the arteries	637
9	Nephritis, nephrotic syndrome, nephrosis ..	611
	Septicemia	611
	All other causes (Residual)	9,151
Total Deaths - All Causes		49,010

*Leading causes of death are generated from a list of 43 causes of death categories developed by the National Center for Health Statistics to promote comparability in analyses of mortality. For deaths under one year of age, a list of 27 causes of death was used. See Appendices for the ICD-9 codes for these lists of causes.

TABLE F:
Leading Causes of Death* by Race
North Carolina Residents, 1998

WHITE

Rank	Cause	Number
1	Heart disease	15,284
2	Cancer	12,003
3	Cerebrovascular disease	4,138
4	Chronic obstructive pulmonary disease ...	2,802
5	Pneumonia & influenza	2,170
6	Diabetes mellitus	1,193
7	Motor vehicle injuries	1,196
8	Other unintentional injuries	1,233
9	Suicide	742
10	Other diseases of the arteries	599
	All other causes (Residual)	10,513
Total Deaths - All Causes		51,873

BLACK

Rank	Cause	Number
1	Heart disease	3,971
2	Cancer	3,182
3	Cerebrovascular disease	1,252
4	Diabetes mellitus	728
5	Pneumonia & influenza	500
6	Motor vehicle injuries	391
7	Chronic obstructive pulmonary disease	370
8	Homicide & legal intervention	364
9	HIV/AIDS	338
10	Other unintentional injuries	331
	All other causes (Residual)	3,770
Total Deaths - All Causes		15,197

AMERICAN INDIAN

Rank	Cause	Number
1	Heart disease	159
2	Cancer	101
3	Diabetes mellitus	38
4	Cerebrovascular disease	34
5	Motor vehicle injuries	31
6	Chronic obstructive pulmonary disease	25
7	Homicide & legal intervention	22
8	Other unintentional injuries	17
9	Conditions originating in perinatal period	13
	Pneumonia & influenza	13
	All other causes (Residual)	106
Total Deaths - All Causes		559

*Racial group totals will not add up to overall total because deaths occurring among other races are not included here. Caution should be taken when comparing the number of deaths across racial groupings. Population size varies considerably from one racial group to another. The number of deaths for each group is to a large extent a reflection of that population size.

TABLE G:
Leading Causes of Death by Sex
North Carolina Residents, 1998

FEMALE			MALE		
Rank	Cause	Number	Rank	Cause	Number
1	Heart disease	9,858	1	Heart disease	9,583
2	Cancer	7,069	2	Cancer	8,258
3	Cerebrovascular disease	3,337	3	Cerebrovascular disease	2,097
4	Pneumonia & influenza	1,490	4	Chronic obstructive pulmonary disease ...	1,767
5	Chronic obstructive pulmonary disease ...	1,433	5	Pneumonia & influenza	1,198
6	Diabetes mellitus	1,068	6	Motor vehicle injuries	1,111
7	Other unintentional injuries	590	7	Other unintentional injuries	996
8	Motor vehicle injuries	521	8	Diabetes mellitus	895
9	Septicemia	479	9	Suicide	671
10	Nephritis, nephrotic syndrome, nephrosis ...	370	10	Homicide & legal intervention	513
	All other causes (Residual)	7,703		All other causes (Residual)	6,791
Total Deaths - All Causes		33,918	Total Deaths - All Causes		33,880

TABLE H:
Leading Causes of Death* by Hispanicity
North Carolina Residents, 1998

HISPANIC			NON-HISPANIC		
Rank	Cause	Number	Rank	Cause	Number
1	Motor vehicle injuries	91	1	Heart disease	19,413
2	Homicide & legal intervention	43	2	Cancer	15,307
3	Other unintentional injuries	33	3	Cerebrovascular disease	5,425
4	Heart disease	24	4	Chronic obstructive pulmonary disease ...	3,200
5	Cancer	20	5	Pneumonia & influenza	2,687
6	Congenital anomalies (birth defects)	16	6	Diabetes mellitus	1,960
7	Suicide	15	7	Motor vehicle injuries	1,552
8	Cerebrovascular disease	9	8	Other unintentional injuries	1,540
	Conditions originating in perinatal period	9	9	Suicide	831
	Symptoms/signs & ill-defined conditions	9	10	Septicemia	788
	All other causes (Residual)	32		All other causes (Residual)	14,773
Total Deaths - All Causes		301	Total Deaths - All Causes		67,476

*Ethnicity group totals will not add up to overall total because deaths with unknown Hispanicity are not included here.

STATE AND COUNTY MORTALITY TABLES AND FIGURES

Table I:
Mortality Statistics Summary for 1998
All North Carolina Residents*

Cause of Death	Number of Deaths 1998	Death Rate 1998*
Total Deaths – All Causes	67,798	9.0
Heart Disease	19,441	257.6
Cerebrovascular Disease	5,434	72.0
Atherosclerosis	395	5.2
Cancer	15,327	203.1
Lip, Oral Cavity, & Pharynx	225	3.0
Stomach	335	4.4
Colon, Rectum, & Anus	1,517	20.1
Liver	283	3.7
Pancreas	846	11.2
Larynx	114	1.5
Trachea, Bronchus, & Lung	4,692	62.2
Malignant Melanoma	228	3.0
Bladder	268	3.6
Brain Tumors	346	4.6
Non-Hodgkins Lymphoma	609	8.1
Leukemia	555	7.4
AIDS	432	5.7
Septicemia	789	10.5
Diabetes Mellitus	1,963	26.0
Pneumonia & Influenza	2,688	35.6
Chronic Obstructive Pulmonary Disease (COPD)	3,200	42.4
Chronic Liver Disease & Cirrhosis	699	9.3
Nephritis & Nephrosis	702	9.3
Unintentional Motor Vehicle Injuries	1,632	21.6
All Other Unintentional Injuries & Adverse Effects	1,586	21.0
Suicide	846	11.2
Homicide	664	8.8

Table J:
Sex-Specific Mortality Statistics Summary for 1998
North Carolina Male and Female Residents*

Cause of Death	Number of Deaths 1998	Death Rate 1998
Cancer		
Female Breast	1,163	29.9
Cervix Uteri	124	3.2
Ovary & Other Uterine Adnexa	333	8.6
Prostate	983	26.9

Note: The death rate for all causes is per 1,000 population while cause-specific death rates are per 100,000 population. The death rates in Table J cannot be compared to those in Table I because the denominators are sex-specific. Therefore, in ranking the causes of death—for example, in ranking the leading cancer sites—one must use the observed numbers of deaths.

* See Appendices for Cause of Death codes.

Total Deaths – All Causes

Introduction

During 1998 a total of 67,798 North Carolinians died. This number represents an annual death rate of 9.0 resident deaths per 1,000 population. One confounding factor in making comparisons of mortality rates is that age structure of a population, which has an important impact on mortality, may vary among geographic areas and over time. It is important to adjust for age when comparing death rates among counties within North Carolina. Also, adjustment for age affects comparisons of North Carolina to the nation as a whole. North Carolina's unadjusted overall death rate for 1997 of 8.9 was 3 percent higher than the 1997 death rate for the United States of 8.6.¹ After adjustment for age, North Carolina's 1997 death rate was 7 percent higher than that for the United States. This suggests that North Carolina has a somewhat younger population than the nation as a whole. Since death rates are much lower in the younger age groups, a younger population will tend to reduce the unadjusted death rate.

Differentials and Trends

While the North Carolina trend for unadjusted rates indicates some increase in mortality, due to aging of the population, examination of age-adjusted rates shows a different pattern. From 1979-83 to 1994-98 the risk of death for North Carolinians declined by 8 percent, from 10.2 to 9.4 per 1,000 population (using the projected United States year 2000 population as the standard for adjustment).

General comparisons of mortality can mask variations by race and sex. Looking at North Carolina deaths in the 1994-98 period, the age-adjusted male rate (12.1) exceeded the female rate (7.6) by 59 percent. There is little difference in the 1994-98 unadjusted death rates by race: 9.0 for whites compared to 8.9 for minorities. The minority population has a younger age distribution than whites and this accounts for their similar unadjusted death rates. Comparing the age-adjusted death rates for 1994-98, the rates are 11.9 for minorities and 8.8 for whites. By race and sex, the age-adjusted death rates for 1994-98 were as follows: 11.2 for white males, 7.1 for white females, 15.9 for minority males, and 9.3 for minority females. In the following sections, important differences in the risk of mortality by race and sex groups are described for the major causes of death.

Risk Factors

See the section "Overview of Mortality in North Carolina" for a review of general mortality risk factors.

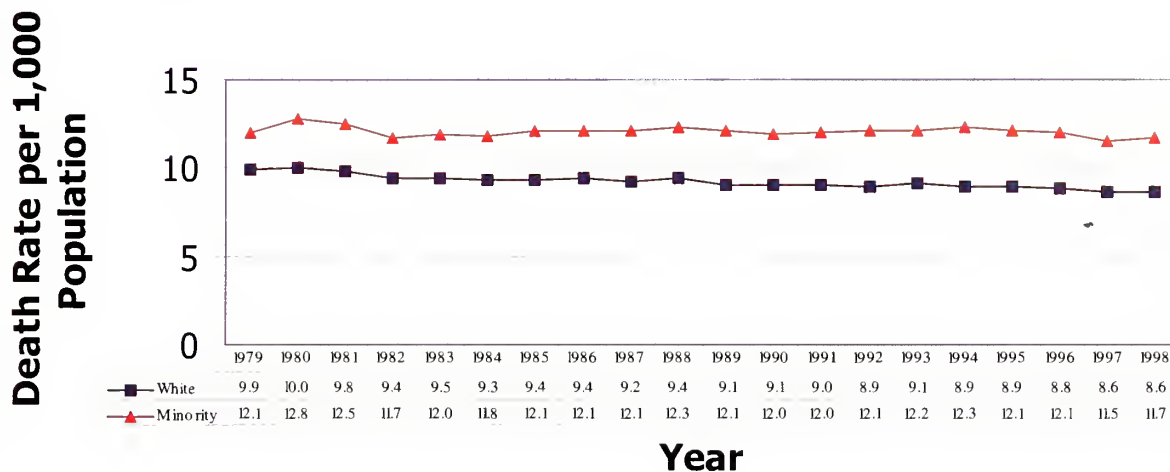
Geographic Patterns

The 1994-98 unadjusted total mortality rates for counties ranged from 14.1 in Polk County to 5.6 in Wake County, with a state rate of 9.0 per 1,000 population. Figure 1.C shows several scattered groups of high-rate counties, with the northeast having the largest cluster. This general pattern persists in eastern North Carolina after adjustment for age (Figure 1.D), which indicates that factors other than age distribution are causing the higher rates in these counties. Figure 1.D shows a large band of contiguous, high-rate counties extending from Virginia to South Carolina in the eastern third of North Carolina.

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1. Hoyert DL, Kochanek KD, Murphy SL. Deaths: final data for 1997. *National Vital Statistics Reports 1999*, 47(19). Hyattsville, Maryland: National Center for Health Statistics.

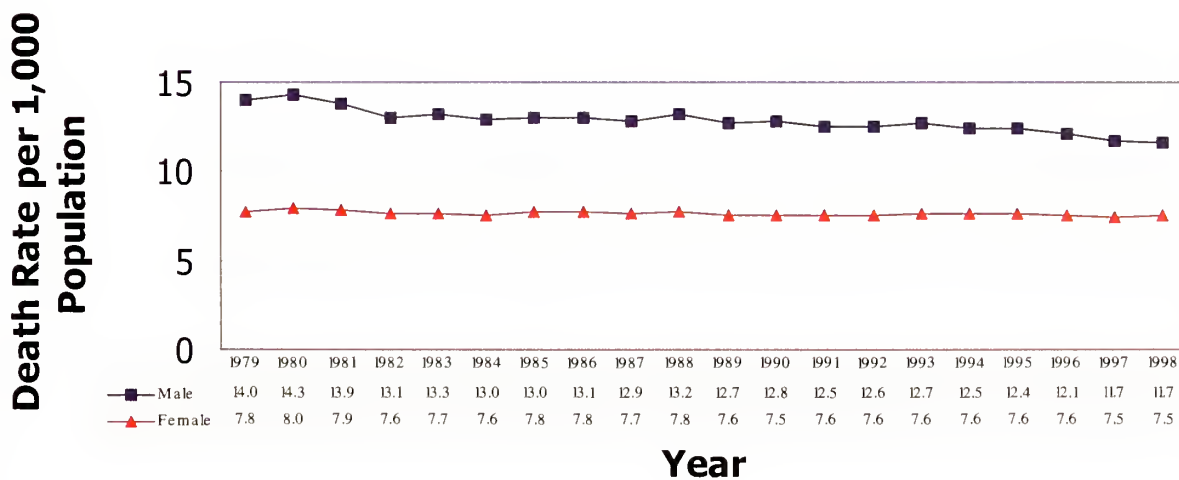
Total Deaths - All Causes: North Carolina Resident Age-Adjusted* Death Rates by Race 1979-1998



*U.S. 2000 standard population

Figure 1.A

Total Deaths - All Causes: North Carolina Resident Age-Adjusted* Death Rates by Sex 1979-1998



*U.S. 2000 standard population

Figure 1.B

TABLE 1
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Total Deaths – All Causes

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	67,798	9.0	327,884	9.0	10.2	9.9	9.7	9.4
1 Alamance	1,229	10.1	5,987	10.2	10.2	9.4	9.4	9.0
2 Alexander	280	8.8	1,278	8.3	9.8	9.1	9.4	9.0
3 Alleghany	129	13.1	660	13.6	9.2	9.0	8.6	9.2
4 Anson	255	10.6	1,356	11.3	10.3	10.2	10.4	10.0
5 Ashe	286	12.1	1,380	11.8	9.1	8.8	8.8	8.8
6 Avery	191	12.5	892	11.7	10.5	10.2	9.8	10.0
7 Beaufort	536	12.3	2,617	12.1	11.4	11.3	11.0	10.6
8 Bertie	262	13.1	1,315	12.9	11.7	11.5	11.4	12.1
9 Bladen	375	12.2	1,798	12.0	11.5	11.1	11.3	10.8
10 Brunswick	662	9.8	3,110	9.9	9.9	9.4	9.4	9.3
11 Buncombe	2,113	10.9	10,360	10.9	9.6	9.4	9.0	8.9
12 Burke	873	10.4	3,854	9.4	9.5	9.7	9.3	9.0
13 Cabarrus	1,081	9.0	4,991	8.8	10.2	9.5	9.0	8.9
14 Caldwell	664	8.8	3,379	9.1	9.6	9.8	9.4	9.1
15 Camden	66	10.3	322	10.2	11.2	10.2	9.7	10.0
16 Carteret	601	10.1	2,895	10.0	10.3	9.8	9.5	9.3
17 Caswell	257	11.5	1,167	10.8	10.3	9.5	9.7	9.4
18 Catawba	1,222	9.3	5,795	9.1	9.9	9.7	9.7	9.5
19 Chatham	461	10.0	2,130	9.7	9.8	9.5	8.9	8.7
20 Cherokee	290	12.7	1,342	12.1	8.4	8.3	8.2	8.8
21 Chowan	163	11.3	865	12.2	10.9	10.5	10.0	9.4
22 Clay	101	12.3	488	12.4	9.5	8.6	7.6	8.7
23 Cleveland	959	10.4	4,710	10.5	10.4	10.0	10.1	9.8
24 Columbus	599	11.5	2,891	11.2	11.4	11.0	11.3	10.7
25 Craven	817	9.2	3,730	8.6	10.9	10.0	9.8	9.8
26 Cumberland	1,826	6.2	8,958	6.1	11.2	11.6	10.7	10.0
27 Currituck	155	9.0	771	9.5	10.2	11.4	10.2	10.2
28 Dare	206	7.3	990	7.5	8.8	8.9	8.8	8.8
29 Davidson	1,170	8.3	5,987	8.7	9.4	9.4	9.2	9.0
30 Davie	335	10.4	1,492	9.8	9.3	10.3	8.6	8.9
31 Duplin	488	11.0	2,540	11.7	11.2	10.9	10.9	11.1
32 Durham	1,728	8.6	8,439	8.6	10.5	10.1	9.7	10.4
33 Edgecombe	644	11.8	3,130	11.2	11.4	11.1	11.7	11.6
34 Forsyth	2,707	9.3	12,953	9.1	10.0	9.7	9.6	9.2
35 Franklin	411	9.2	1,988	9.3	10.7	9.3	10.0	9.6
36 Gaston	1,826	10.1	8,938	10.0	10.3	10.4	10.3	10.4
37 Gates	105	10.5	563	11.4	10.0	10.8	10.7	11.1
38 Graham	77	10.3	451	12.1	8.5	9.8	9.4	9.7
39 Granville	456	10.2	2,115	10.0	11.3	10.4	10.4	10.4
40 Greene	160	8.7	783	9.1	10.8	10.0	9.1	9.0
41 Guilford	3,272	8.4	16,514	8.8	10.0	9.7	9.6	9.1
42 Halifax	650	11.7	3,351	11.9	11.8	10.7	11.2	11.2
43 Harnett	745	8.9	3,525	8.9	11.5	11.1	10.0	9.8
44 Haywood	584	11.3	2,893	11.5	9.3	9.3	8.6	8.0
45 Henderson	1,032	12.8	5,001	12.9	8.7	8.3	8.4	8.3
46 Hertford	273	12.7	1,340	12.1	10.2	10.7	11.1	10.9
47 Hoke	212	7.1	1,024	7.3	10.1	9.2	10.9	9.3
48 Hyde	60	10.5	335	12.6	10.7	10.7	11.1	10.3
49 Iredell	1,049	9.2	5,047	9.5	10.0	9.6	9.4	9.3
50 Jackson	296	10.0	1,376	9.5	9.0	9.0	8.7	8.5

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.
Note: Death rates in this table are per 1,000 population while cause-specific death rates are per 100,000 population.

TABLE 1 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Total Deaths – All Causes

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	977	9.1	4,545	9.1	11.5	10.5	10.1	9.7
52 Jones	121	13.1	573	12.3	10.1	10.0	9.6	11.6
53 Lee	472	9.7	2,212	9.4	11.6	10.3	10.1	9.4
54 Lenoir	686	11.7	3,359	11.4	11.9	11.1	11.1	10.8
55 Lincoln	499	8.4	2,413	8.5	10.0	9.6	9.4	9.2
56 McDowell	416	10.4	1,932	10.1	9.2	9.8	9.4	8.8
57 Macon	349	12.4	1,741	12.9	8.8	8.5	7.8	8.0
58 Madison	205	10.9	996	11.0	9.6	9.7	9.6	8.6
59 Martin	293	11.4	1,433	11.1	10.9	11.2	10.8	10.2
60 Mecklenburg	4,251	6.8	20,846	7.0	10.0	9.5	9.5	9.2
61 Mitchell	182	12.4	946	12.9	10.2	9.5	9.2	9.3
62 Montgomery	248	10.0	1,161	9.6	10.7	9.7	9.8	9.7
63 Moore	859	12.1	3,928	11.6	10.4	9.9	8.5	8.1
64 Nash	820	9.3	4,007	9.4	11.7	10.9	10.8	9.9
65 New Hanover	1,258	8.5	6,117	8.6	10.6	10.4	9.5	8.8
66 Northampton	246	11.9	1,320	12.7	12.0	11.4	10.7	10.5
67 Onslow	739	5.0	3,438	4.6	10.3	9.7	9.6	10.1
68 Orange	651	6.0	3,065	5.7	9.5	8.8	8.4	8.0
69 Pamlico	162	13.4	707	11.8	10.2	9.4	9.5	9.2
70 Pasquotank	325	9.3	1,718	10.1	10.6	10.0	10.1	9.7
71 Pender	343	9.0	1,699	9.5	10.4	9.9	9.6	9.1
72 Perquimans	135	12.3	680	12.6	9.2	9.5	9.3	9.7
73 Person	324	9.7	1,706	10.5	10.2	9.5	9.4	9.6
74 Pitt	1,004	7.9	4,923	8.2	11.3	11.1	10.7	10.5
75 Polk	249	14.9	1,137	14.1	9.4	8.7	8.8	8.1
76 Randolph	989	8.0	4,863	8.2	9.5	9.2	9.1	8.5
77 Richmond	490	10.8	2,598	11.4	11.1	10.5	10.9	10.9
78 Robeson	1,128	9.9	5,472	9.8	11.5	11.3	11.3	11.5
79 Rockingham	1,004	11.2	4,838	10.9	10.6	10.4	9.9	9.8
80 Rowan	1,379	11.1	6,518	10.8	9.6	9.4	9.5	9.5
81 Rutherford	698	11.6	3,435	11.6	10.0	9.6	9.6	9.9
82 Sampson	629	11.8	2,935	11.4	10.9	10.7	10.5	10.5
83 Scotland	365	10.4	1,753	10.0	11.6	12.0	11.5	11.4
84 Stanly	629	11.3	2,921	10.7	10.0	9.6	9.2	9.8
85 Stokes	380	8.8	1,811	8.6	9.7	9.6	9.4	9.2
86 Surry	747	11.0	3,602	10.9	9.8	9.5	9.0	9.4
87 Swain	140	11.5	714	12.1	10.8	11.4	11.2	10.3
88 Transylvania	324	11.4	1,550	11.2	8.3	8.2	7.8	7.9
89 Tyrrell	50	12.8	225	11.9	11.5	11.3	10.2	9.4
90 Union	803	7.3	3,731	7.3	9.4	9.3	9.7	9.6
91 Vance	486	11.7	2,356	11.6	11.5	11.0	11.7	11.9
92 Wake	3,223	5.6	15,016	5.6	9.8	9.3	8.6	8.5
93 Warren	240	12.7	1,087	11.9	11.2	11.4	10.0	9.2
94 Washington	158	12.1	777	11.5	11.9	11.3	10.4	10.6
95 Watauga	290	7.1	1,342	6.7	8.2	8.0	7.2	7.7
96 Wayne	1,012	8.9	4,857	8.7	11.3	11.6	10.9	10.4
97 Wilkes	644	10.2	2,889	9.2	9.9	9.8	9.4	8.7
98 Wilson	747	10.8	3,759	11.0	11.9	11.4	11.5	11.2
99 Yadkin	334	9.4	1,612	9.4	9.0	9.6	9.3	8.2
100 Yancey	156	9.4	805	9.9	8.3	8.0	8.3	7.4

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Note: Death rates in this table are per 1,000 population while cause-specific death rates are per 100,000 population.

Total Deaths - All Causes

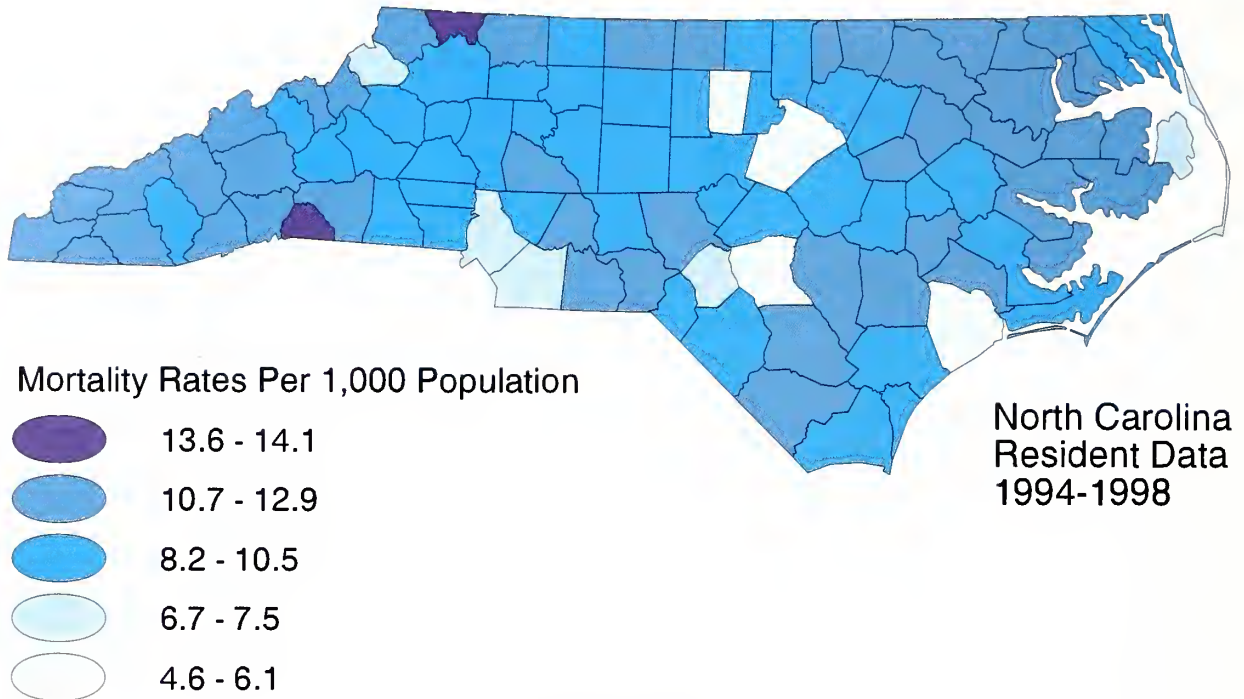


Figure 1.C

Total Deaths - All Causes

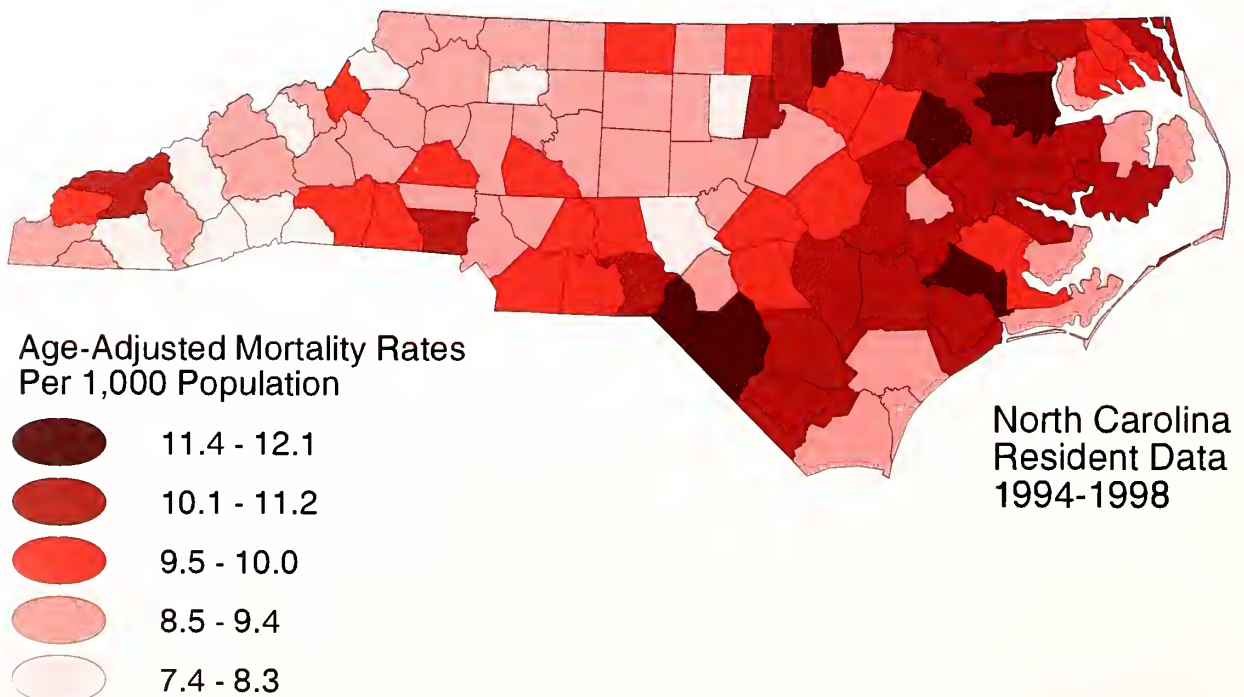


Figure 1.D

Heart Disease

Introduction

Heart disease is the leading cause of death in North Carolina and in the nation. In 1998, heart disease was responsible for 19,441 deaths in North Carolina; accounting for 29 percent of all deaths in the state. Heart disease has an overall mortality rate of 257.6 per 100,000 North Carolina residents.

Differentials and Trends

In 1998, the age-adjusted heart disease mortality rate was 59 percent higher for males (339.5 per 100,000 population) than for females (213.6). In addition, the 1998 age-adjusted heart disease mortality rate was 26 percent higher for minorities than for whites (319.6 vs. 254.4 per 100,000 population). Between 1979 and 1998, the North Carolina age-adjusted heart disease mortality rate declined by 34 percent. Despite the overall reduction in heart disease deaths, important differences exist in the rates of decline by race and sex. From 1979 to 1998, the age-adjusted heart disease mortality rate decreased 37 percent among whites — from 402.0 to 254.4; but only 22 percent among minorities — from 409.6 to 319.6. During this same time period, the age-adjusted heart disease death rate declined 39 percent among males, from 554.4 to 339.5, but only 28 percent among females, from 297.6 to 213.6.

These age-adjusted heart disease mortality trends indicate a growing gap between minorities and whites, and a narrowing gap between males and females. In 1979, the heart disease mortality rate for minorities and whites was essentially the same, but by 1998 the rate was 26 percent higher for minorities than for whites. In contrast, the gap between males and females decreased during this same period. The heart disease mortality rate for males was 86 percent higher for males than for females in 1979, and 59 percent higher in 1998.

Risk Factors

Risk factors for heart disease include obesity, physical inactivity, poor nutrition, tobacco use, high blood pressure, elevated cholesterol, and diabetes.¹ Changes in lifestyle factors, such as smoking cessation and weight control, coupled with improved access to early detection and better medical treatment have led to the decline in heart disease deaths during the past 20 years. The primary modifiable risk factors for heart disease are tobacco use, physical inactivity, and inadequate nutrition.²

Cigarette smoking is so significant a risk factor that the Surgeon General has called it "the most important of the known modifiable risk factors for coronary heart disease in the United States".³ Smokers are twice as likely as nonsmokers to suffer a heart attack and have two to four times the risk of nonsmokers for sudden cardiac death. Further, smokers who have a heart attack are more likely than nonsmokers to die and die suddenly (within an hour).⁴ In 1997, 26 percent of North Carolina adults were current smokers. This was the eleventh highest prevalence in the nation, above the United States median of 24 percent.⁵

Physically inactive people are almost twice as likely as those who engage in regular physical activity to develop heart disease.⁶ Regular moderate-to-vigorous physical activity plays a significant role in preventing heart disease, and helps to control other risk factors, such as obesity, high blood

pressure, and elevated cholesterol.⁴ Risk from physical inactivity is comparable to the highly recognized risks of smoking, high blood pressure, and elevated cholesterol. However, physical inactivity is more prevalent than any of these risk factors.⁶ Physical inactivity poses a serious health threat to North Carolinians. In 1996, only 14 percent of North Carolina adults engaged in regular and sustained physical activity. This was the eighth lowest prevalence in the nation, falling below the United States median of 21 percent.

Poor diet is another leading contributor to heart disease. A diet high in fat contributes to elevated cholesterol, obesity, and diabetes.⁷ Despite having many healthy food options available, North Carolinians generally consume a high-fat, low-fiber diet, and the proportion of who are overweight is increasing.⁵ In 1996, only 17 percent of North Carolina's adults reported eating at least five fruits and vegetables daily. This was the fifth lowest prevalence in the nation, falling below the United States median of 24 percent. Further, 31 percent reported being overweight, the twentieth highest prevalence in the United States.

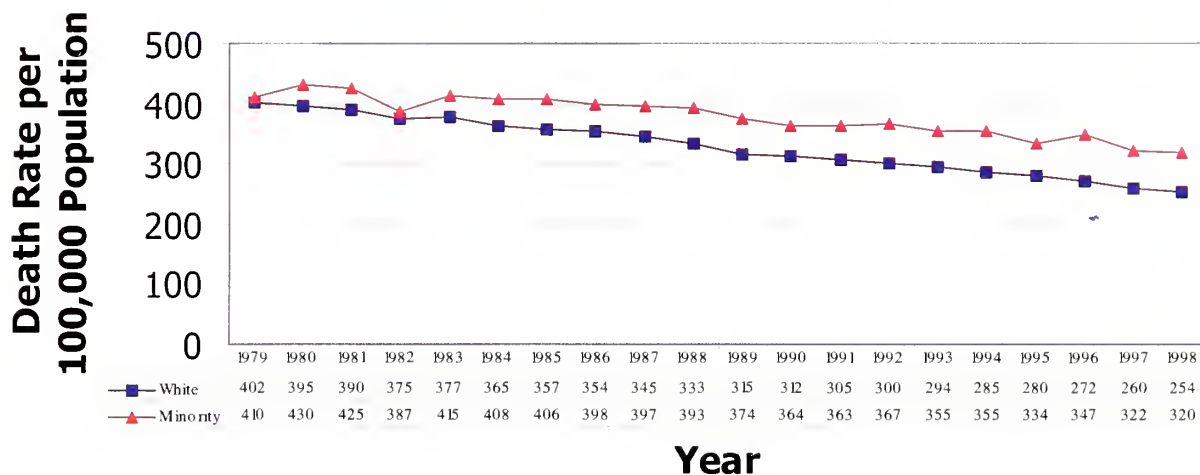
Geographic Patterns

While the heart disease death rate is decreasing overall in the state, relatively high unadjusted rates remain in several parts of North Carolina. After adjusting for age, several pockets of counties in the eastern part of the state and along the South Carolina border continue to have high rates, indicating that these counties are experiencing high heart disease mortality that cannot be explained by age. These counties tend to be rural and have poorer socioeconomic profiles. In contrast, urban counties, such as Buncombe, Mecklenburg, and Wake, exhibit relatively low rates of age-adjusted heart disease mortality.

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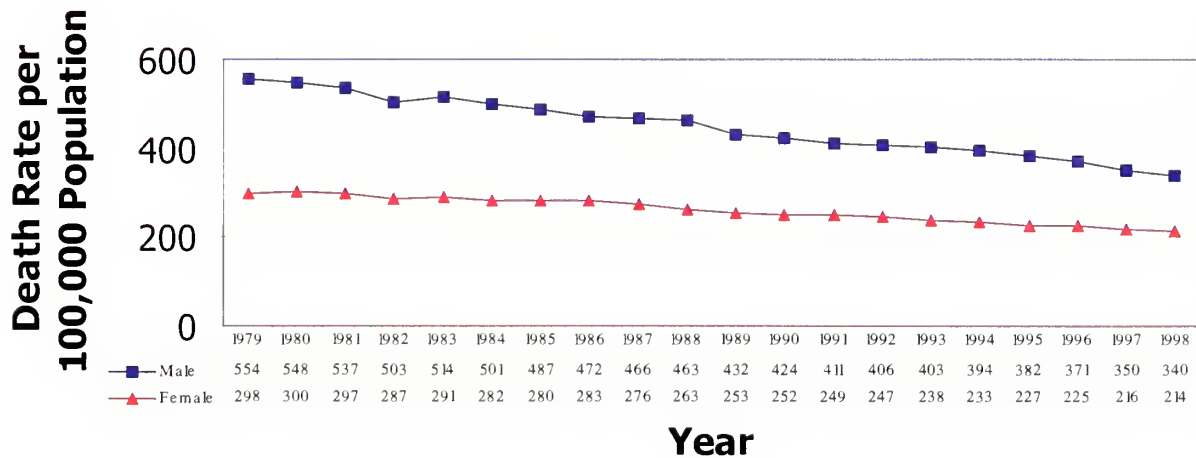
Heart Disease: North Carolina Resident Age-Adjusted* Death Rates by Race 1979-1998



*U.S. 2000 standard population

Figure 2.A

Heart Disease: North Carolina Resident Age-Adjusted* Death Rates by Sex 1979-1998



*U.S. 2000 standard population

Figure 2.B

TABLE 2
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Heart Disease

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	19,441	257.6	97,162	265.8	392.2	359.7	316.3	282.0
1 Alamance	351	288.5	1,736	295.1	400.2	337.8	304.5	258.8
2 Alexander	85	266.4	406	264.7	364.9	377.0	321.0	292.7
3 Alleghany	34	345.0	193	399.0	298.0	285.3	289.5	261.0
4 Anson	93	387.1	454	379.9	399.6	401.9	376.0	324.3
5 Ashe	74	312.3	399	341.9	395.1	341.7	289.2	246.8
6 Avery	59	385.1	314	411.7	481.4	425.4	377.5	348.3
7 Beaufort	199	457.0	896	413.4	417.2	420.5	369.0	358.0
8 Bertie	75	374.4	375	367.8	447.5	411.5	342.4	340.3
9 Bladen	128	416.0	569	378.2	446.5	410.7	365.7	336.2
10 Brunswick	196	291.2	960	305.1	394.6	352.0	321.3	293.3
11 Buncombe	634	328.0	3,063	322.5	355.9	315.4	274.6	257.3
12 Burke	265	315.1	1,190	289.7	383.6	396.8	335.1	277.9
13 Cabarrus	343	284.2	1,593	280.3	396.4	337.0	310.9	287.1
14 Caldwell	212	281.2	1,102	296.9	375.7	368.3	327.6	300.4
15 Camden	17	266.5	78	247.0	419.5	330.7	310.4	248.5
16 Carteret	190	320.6	917	315.2	452.6	378.1	297.3	298.1
17 Caswell	85	379.8	364	335.5	410.7	337.7	310.4	287.9
18 Catawba	345	262.3	1,610	251.8	400.9	380.2	318.3	264.5
19 Chatham	118	256.9	627	284.6	386.8	349.1	271.1	252.4
20 Cherokee	87	381.9	437	395.3	316.3	321.6	295.0	280.1
21 Chowan	52	361.6	261	368.8	312.9	327.8	313.5	277.0
22 Clay	38	461.3	160	405.7	436.8	320.5	267.0	274.7
23 Cleveland	279	303.9	1,609	357.8	468.3	400.2	371.4	336.0
24 Columbus	208	398.7	1,020	395.0	445.5	417.4	390.4	375.9
25 Craven	234	262.9	1,073	246.7	390.6	354.5	319.5	290.0
26 Cumberland	493	168.4	2,424	165.1	421.3	443.4	389.1	300.8
27 Currituck	46	268.0	214	263.1	442.2	417.2	316.3	280.4
28 Dare	63	223.9	300	226.2	349.0	303.2	263.6	274.4
29 Davidson	366	258.9	1,922	277.8	376.6	358.0	335.4	291.9
30 Davie	106	329.6	509	332.7	348.8	379.9	290.3	300.6
31 Duplin	124	280.2	718	331.4	425.1	397.5	329.1	313.5
32 Durham	410	204.2	2,195	224.6	382.0	329.1	272.6	278.6
33 Edgecombe	170	310.8	897	321.1	403.9	371.8	364.3	335.7
34 Forsyth	744	256.8	3,639	256.8	389.2	341.6	291.8	259.2
35 Franklin	106	238.5	555	260.9	431.2	359.2	316.4	267.9
36 Gaston	541	298.8	2,815	313.9	428.9	420.2	392.5	331.8
37 Gates	19	190.1	169	342.7	427.5	366.5	372.1	334.1
38 Graham	16	214.4	118	315.6	321.2	385.4	325.3	249.7
39 Granville	111	249.4	594	281.7	435.2	384.1	338.2	294.8
40 Greene	38	207.1	223	258.2	421.3	386.2	315.7	256.2
41 Guilford	855	220.3	4,461	236.4	362.9	334.0	293.2	246.4
42 Halifax	200	360.9	1,104	390.9	442.3	401.1	373.8	363.0
43 Harnett	190	227.3	1,028	259.4	475.0	409.7	340.3	292.1
44 Haywood	200	387.5	990	392.0	377.3	356.9	288.6	266.3
45 Henderson	261	322.7	1,467	377.2	321.2	289.4	268.3	231.1
46 Hertford	63	292.2	388	350.8	392.0	387.3	328.5	309.4
47 Hoke	49	163.1	265	187.9	350.5	331.9	346.6	256.4
48 Hyde	27	470.3	138	517.0	362.2	356.5	383.6	421.0
49 Iredell	340	299.5	1,567	293.9	385.6	354.6	315.7	289.7
50 Jackson	76	257.1	387	266.6	358.9	340.6	278.0	236.8

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 2 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Heart Disease

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	291	270.2	1,414	284.5	492.9	423.9	380.9	307.2
52 Jones	37	399.4	156	334.9	337.4	315.9	336.6	319.5
53 Lee	142	291.2	660	280.4	452.6	403.3	336.5	286.7
54 Lenoir	201	343.1	1,021	346.5	443.5	430.9	362.3	327.6
55 Lincoln	151	255.6	789	277.7	401.9	366.1	334.4	307.0
56 McDowell	127	316.6	581	302.9	387.4	380.6	351.3	261.7
57 Macon	110	390.7	557	413.8	341.5	300.5	250.1	243.3
58 Madison	62	329.9	291	320.9	368.3	336.5	280.9	243.2
59 Martin	81	316.0	438	339.7	425.8	410.9	329.9	314.6
60 Mecklenburg	1,066	170.7	5,517	186.1	363.6	327.7	286.6	253.8
61 Mitchell	63	430.8	319	435.2	367.8	312.4	307.0	302.5
62 Montgomery	79	319.6	369	304.7	434.3	343.6	332.1	307.8
63 Moore	273	385.5	1,213	356.7	373.6	343.2	266.4	241.7
64 Nash	239	271.2	1,212	283.2	425.8	404.8	350.0	302.2
65 New Hanover	360	242.6	1,864	261.4	400.5	353.1	299.5	274.4
66 Northampton	75	361.4	378	364.3	453.0	393.3	354.5	291.1
67 Onslow	209	140.3	982	132.4	396.0	309.0	311.8	326.0
68 Orange	155	141.8	802	150.4	322.9	274.8	242.5	217.1
69 Pamlico	50	413.4	206	344.9	405.3	311.4	273.8	257.8
70 Pasquotank	98	281.9	536	315.8	399.8	413.3	344.6	302.0
71 Pender	93	244.0	505	281.2	375.2	322.3	321.6	274.0
72 Perquimans	38	347.1	197	366.1	308.2	312.3	273.1	268.1
73 Person	93	279.3	507	312.6	444.0	363.9	309.2	284.7
74 Pitt	284	224.3	1,306	216.3	432.6	390.6	301.9	287.3
75 Polk	73	438.0	328	407.6	348.5	287.1	272.2	216.7
76 Randolph	312	251.3	1,547	260.9	358.3	346.5	312.4	274.7
77 Richmond	181	397.7	883	388.2	425.3	365.9	374.9	373.5
78 Robeson	332	290.1	1,636	292.1	407.3	408.1	380.6	358.3
79 Rockingham	257	286.7	1,373	309.2	401.1	396.3	327.5	275.9
80 Rowan	426	341.6	2,093	346.4	361.4	327.5	322.9	300.1
81 Rutherford	243	404.6	1,129	380.8	399.9	366.7	354.1	321.3
82 Sampson	165	309.5	818	317.2	439.4	393.8	350.3	288.7
83 Scotland	133	377.8	605	346.5	436.4	450.0	413.1	405.6
84 Stanly	209	375.9	973	356.6	400.3	358.3	333.1	327.6
85 Stokes	85	196.8	505	241.1	353.8	383.0	307.2	257.6
86 Surry	217	319.5	1,148	347.8	378.3	351.1	301.2	298.1
87 Swain	43	353.4	243	411.3	402.7	455.3	382.7	344.7
88 Transylvania	96	339.0	506	366.9	312.6	278.8	244.4	249.5
89 Tyrrell	18	462.1	68	360.5	502.0	476.5	408.0	281.3
90 Union	265	240.7	1,223	239.4	355.4	370.8	363.2	334.3
91 Vance	135	323.8	677	333.1	450.4	419.9	412.0	344.8
92 Wake	808	140.6	3,946	146.9	357.9	316.0	271.1	237.9
93 Warren	68	359.5	305	334.3	389.6	377.7	284.3	246.1
94 Washington	47	358.7	276	408.6	503.0	404.5	365.4	377.4
95 Watauga	75	183.2	427	211.7	320.7	309.9	242.2	246.3
96 Wayne	311	274.5	1,453	259.9	458.7	452.4	372.2	322.7
97 Wilkes	169	266.9	856	273.9	449.2	384.9	304.4	255.3
98 Wilson	223	321.4	1,099	321.5	397.6	393.9	346.5	329.6
99 Yadkin	112	314.1	491	285.2	324.1	350.3	307.6	246.6
100 Yancey	46	277.4	241	296.4	263.9	266.2	246.8	217.4

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Heart Disease

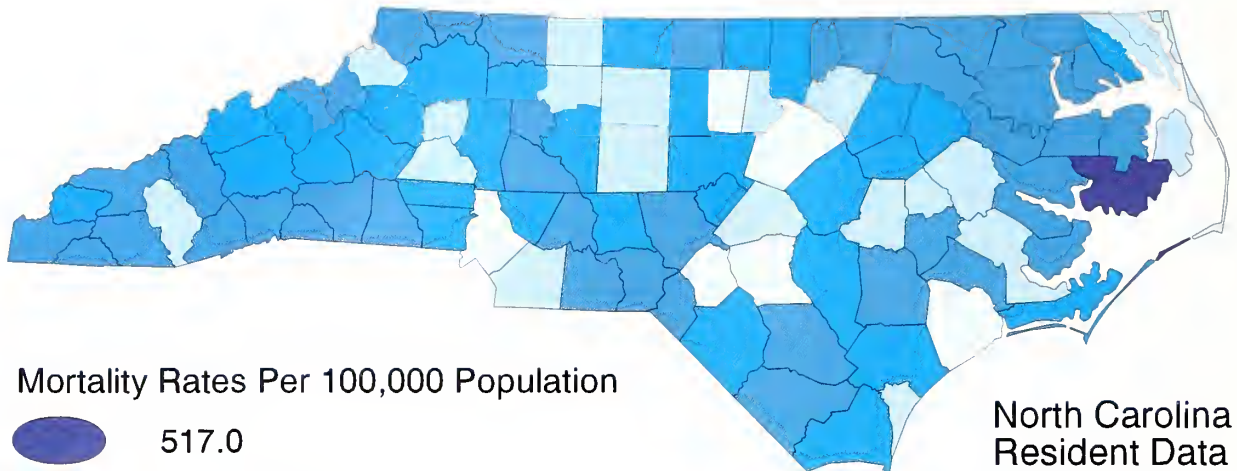


Figure 2.C

Heart Disease

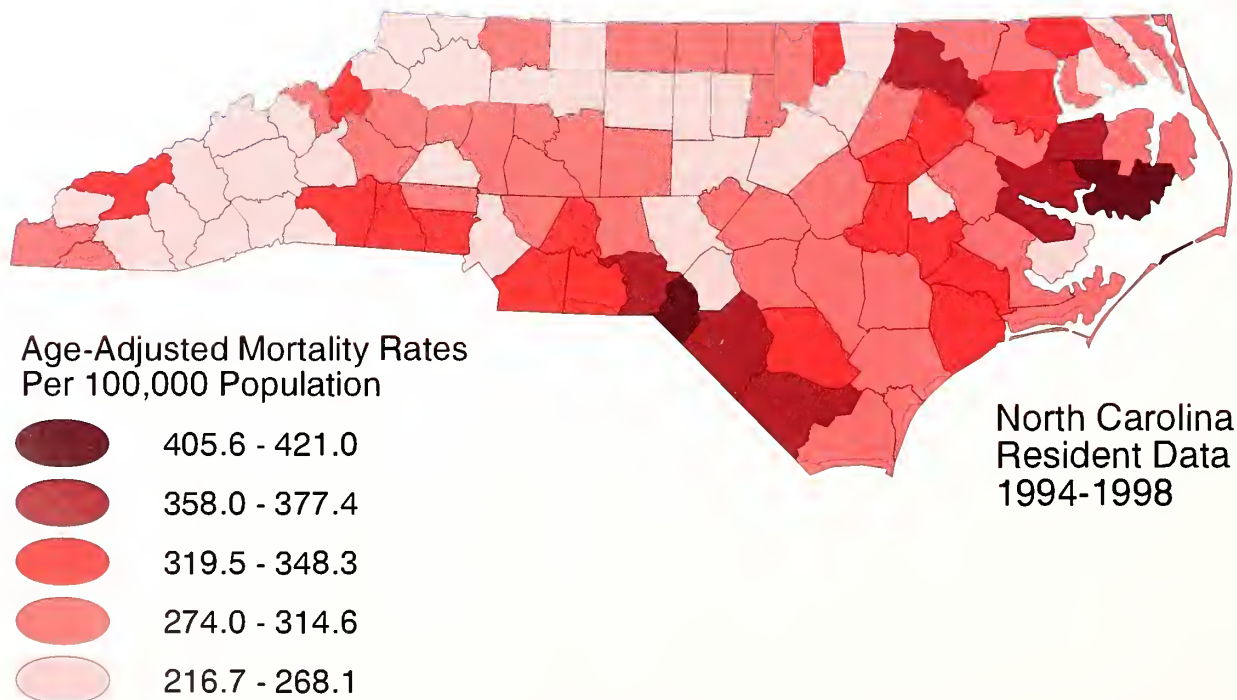


Figure 2.D

Cerebrovascular Disease

Introduction

In 1998 cerebrovascular disease, or stroke, claimed the lives of 5,434 North Carolinians with a death rate of 72.0 per 100,000 population. It ranked as the third leading cause of death behind heart disease and cancer, accounting for 8 percent of all deaths in the state. From 1979 to 1998, the age-adjusted cerebrovascular disease death rate declined every year. During this time period, the rate dropped 37 percent from 119.8 to 75.5 per 100,000 population.

Differentials and Trends

Despite this impressive drop in overall mortality, minorities continue to have exceedingly high rates of cerebrovascular disease deaths. In 1998, the age-adjusted cerebrovascular disease death rate for the minority population was 46 percent higher than for the white population (101.6 vs. 69.7 per 100,000 population). From 1979-1998, the rates diverged, decreasing less for the minority population than for the white population (25 and 40 percent, respectively).

In 1998, the age-adjusted cerebrovascular disease death rate for males of all races was 10 percent higher than for females (79.3 vs. 72.0 per 100,000 population). From 1979-1998, the gap between males and females has narrowed as the rate for males declined more than for females (40 and 35 percent, respectively).

According to 1997 data, North Carolina's cerebrovascular disease death rate is the fourth highest in the nation.¹ This high ranking establishes North Carolina in the "stroke belt," which is an 8- to 10-state region in the southeastern United States. Death rates in the stroke belt are 1.3 to 2.0 times the national average. Individuals living in the stroke belt have a 43 percent greater risk than those living elsewhere in the U.S. of death from a stroke.²

Risk Factors

Many of the risk factors associated with cerebrovascular disease are the same as those for heart disease: obesity, physical inactivity, cigarette smoking, high blood pressure, elevated cholesterol, and diabetes. Additional risk factors include prior stroke, carotid artery disease, heart disease, transient ischemic attacks, and high red blood cell count.³ Minorities are also at greater risk of dying from cerebrovascular disease. The large racial differences we see in cerebrovascular disease death rates is, to some extent, due to a generally higher prevalence of risk factors (except for smoking) and lower prevalence of preventive practices.⁴

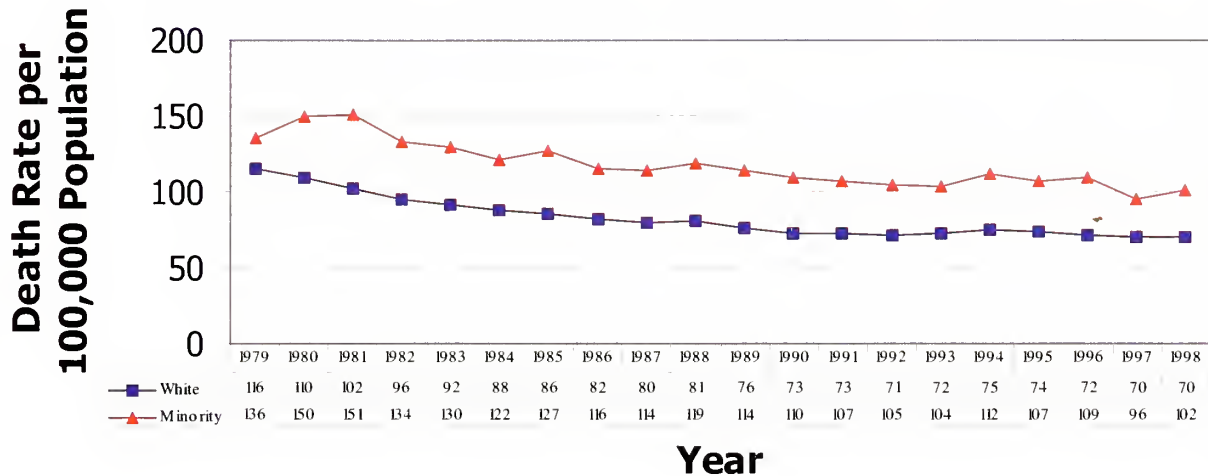
Geographic Patterns

Geographically, there is a scattering of counties with relatively high unadjusted rates, with several pockets of high-rate counties in the eastern and western parts of the state. After adjusting for age, the majority of high-rate counties are clustered in the east. The eastern part of the state is included in the "buckle" of the stroke belt, along with the coastal regions of South Carolina and Georgia. These areas have drastically elevated rates of stroke, even compared with the rest of the stroke belt.²

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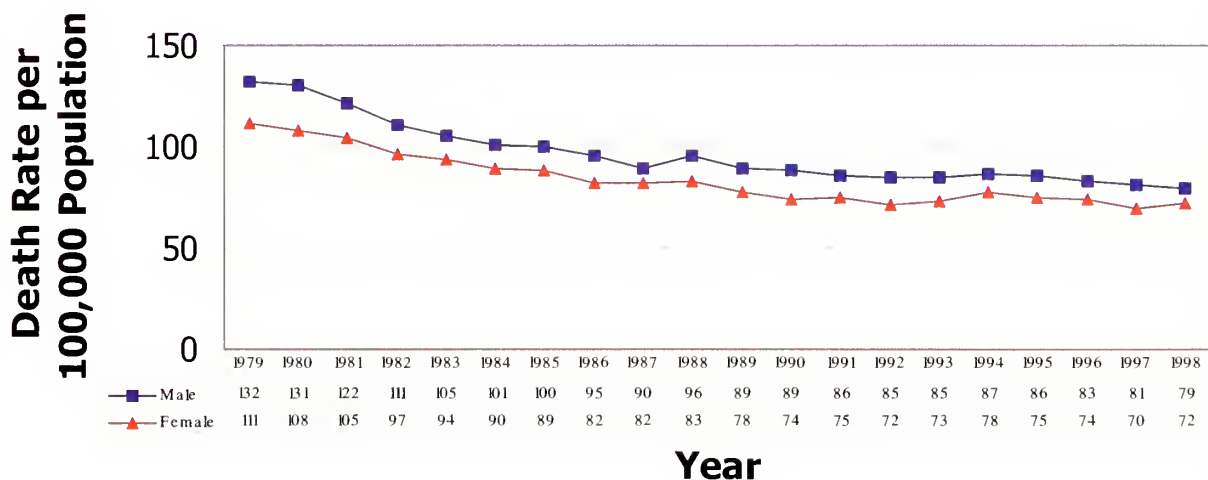
Cerebrovascular Disease: North Carolina Resident Age-Adjusted* Death Rates by Race 1979-1998



*U.S. 2000 standard population

Figure 3.A

Cerebrovascular Disease: North Carolina Resident Age-Adjusted* Death Rates by Sex 1979-1998



*U.S. 2000 standard population

Figure 3.B

TABLE 3
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Cerebrovascular Disease

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	5,434	72.0	26,354	72.1	109.7	90.0	79.6	78.0
1 Alamance	115	94.5	543	92.3	109.3	77.3	78.1	81.8
2 Alexander	15	47.0	71	46.3	97.3	58.4	68.8	52.6
3 Alleghany	13	131.9	56	115.8	108.6	83.2	61.6	72.4
4 Anson	14	58.3	141	118.0	117.5	83.4	96.6	101.4
5 Ashe	23	97.1	111	95.1	71.3	62.1	71.1	67.4
6 Avery	15	97.9	40	52.4	70.0	56.8	38.5	44.7
7 Beaufort	28	64.3	188	86.7	134.3	112.1	79.2	75.3
8 Bertie	24	119.8	99	97.1	101.4	114.9	101.7	90.8
9 Bladen	35	113.7	193	128.3	183.6	100.5	96.2	115.8
10 Brunswick	58	86.2	220	69.9	88.2	68.2	61.3	71.4
11 Buncombe	154	79.7	821	86.4	90.9	87.8	66.5	68.3
12 Burke	72	85.6	252	61.3	94.7	70.3	51.1	59.6
13 Cabarrus	78	64.6	326	57.4	126.1	83.9	62.4	59.2
14 Caldwell	50	66.3	272	73.3	84.4	75.6	72.4	77.3
15 Camden	4	62.7	22	69.7	145.1	80.0	103.5	71.9
16 Carteret	36	60.7	183	62.9	59.8	73.3	70.5	60.9
17 Caswell	16	71.5	81	74.7	142.9	96.8	96.9	64.3
18 Catawba	85	64.6	477	74.6	112.2	79.9	71.5	81.3
19 Chatham	37	80.5	179	81.2	120.4	78.9	69.1	72.8
20 Cherokee	15	65.8	74	66.9	55	67.2	43.6	47.5
21 Chowan	9	62.6	65	91.8	137.2	117.4	101.5	68.1
22 Clay	11	133.5	30	76.1	46.7	61.0	39.6	52.4
23 Cleveland	79	86.1	389	86.5	89.1	75.2	78.0	81.8
24 Columbus	68	130.4	232	89.8	158.8	112.0	95.0	86.9
25 Craven	58	65.2	288	66.2	116.9	93.2	81.1	78.7
26 Cumberland	121	41.3	536	36.5	145.9	115.0	75.6	69.5
27 Currituck	11	64.1	48	59.0	57.5	84.2	62.1	66.7
28 Dare	11	39.1	69	52.0	103.1	68.4	56.9	65.7
29 Davidson	103	72.9	510	73.7	98.7	75.4	76.2	80.5
30 Davie	27	84.0	108	70.6	95.3	85.2	58.0	64.9
31 Duplin	45	101.7	261	120.5	151.4	108.4	123.3	114.9
32 Durham	137	68.2	550	56.3	96.6	76.9	73.3	70.1
33 Edgecombe	69	126.1	299	107.0	151.4	125.7	114.4	112.1
34 Forsyth	223	77.0	1,067	75.3	103.5	83.5	83.1	76.5
35 Franklin	40	90.0	182	85.6	97.8	82.8	81.2	88.9
36 Gaston	121	66.8	586	65.4	100.3	99.7	72.1	70.7
37 Gates	13	130.1	47	95.3	122.9	58.0	78.9	97.6
38 Graham	3	40.2	23	61.5	76.2	53.8	69.5	48.7
39 Granville	39	87.6	162	76.8	109.5	97.5	97.9	81.4
40 Greene	14	76.3	71	82.2	125.2	92.8	65.9	84.3
41 Guilford	288	74.2	1,471	78.0	117.5	96.3	86.0	82.6
42 Halifax	59	106.5	284	100.6	137.4	104.2	109.7	93.9
43 Harnett	56	67.0	246	62.1	107.3	91.5	63.1	71.1
44 Haywood	46	89.1	195	77.2	108.1	70.1	59.3	53.0
45 Henderson	100	123.6	416	107.0	90.7	70.8	63.5	64.1
46 Hertford	21	97.4	116	104.9	80.9	79.7	99.1	92.4
47 Hoke	21	69.9	69	48.9	112.7	72.7	98.5	67.4
48 Hyde	3	52.3	27	101.2	141.4	130.0	96.5	81.1
49 Iredell	91	80.2	435	81.6	121.9	94.3	80.6	83.0
50 Jackson	26	88.0	89	61.3	64.7	60.2	54.9	54.5

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 3 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Cerebrovascular Disease

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	65	60.3	359	72.2	95.5	85.3	85.7	80.3
52 Jones	11	118.7	59	126.7	158.0	123.3	98.2	121.5
53 Lee	30	61.5	137	58.2	123.3	72.8	62.0	59.8
54 Lenoir	73	124.6	354	120.1	170.4	116.4	103.3	115.6
55 Lincoln	41	69.4	192	67.6	121.9	107.3	97.1	77.1
56 McDowell	38	94.7	168	87.6	81.4	92.4	72.5	76.7
57 Macon	34	120.8	124	92.1	66.6	56.8	54.3	52.9
58 Madison	16	85.1	82	90.4	91.5	107.1	101.2	68.3
59 Martin	23	89.7	100	77.6	80.9	115.0	70.0	71.4
60 Mecklenburg	326	52.2	1,578	53.2	98.7	79.3	73.9	75.0
61 Mitchell	20	136.8	77	105.0	109.0	72.9	58.4	71.6
62 Montgomery	13	52.6	67	55.3	92.0	88.3	79.4	56.0
63 Moore	71	100.3	388	114.1	125.4	99.3	84.6	76.4
64 Nash	55	62.4	320	74.8	163.6	106.0	98.0	81.7
65 New Hanover	100	67.4	553	77.6	122.1	120.7	87.3	82.4
66 Northampton	19	91.6	133	128.2	135.4	111.4	102.3	105.2
67 Onslow	41	27.5	199	26.8	88.7	83.6	57.6	67.7
68 Orange	50	45.8	261	49.0	79.4	77.4	62.6	71.9
69 Pamlico	8	66.1	49	82.0	75.1	70.3	83.2	63.9
70 Pasquotank	29	83.4	136	80.1	107.2	65.9	84.6	75.5
71 Pender	36	94.5	163	90.8	140.3	102.8	75.8	91.4
72 Perquimans	18	164.4	77	143.1	119.1	94.5	82.0	104.1
73 Person	39	117.1	189	116.5	101.4	94.1	90.6	107.1
74 Pitt	86	67.9	446	73.9	115.6	112.5	94.8	100.7
75 Polk	24	144.0	97	120.5	103.7	68.8	66.0	60.0
76 Randolph	63	50.7	367	61.9	153.4	105.3	73.8	66.4
77 Richmond	32	70.3	186	81.8	133.5	111.6	89.4	79.5
78 Robeson	92	80.4	435	77.7	146.3	116.8	97.8	97.8
79 Rockingham	93	103.7	469	105.6	130.9	108.6	93.9	94.9
80 Rowan	100	80.2	527	87.2	104.6	93.7	83.4	75.6
81 Rutherford	39	64.9	299	100.8	122.2	93.8	74.9	84.7
82 Sampson	78	146.3	313	121.4	89.7	120.2	107.5	112.3
83 Scotland	26	73.9	134	76.8	133.9	133.8	89.7	92.3
84 Stanly	52	93.5	293	107.4	121.7	110.1	100.8	99.6
85 Stokes	53	122.7	197	94.0	94.9	83.3	88.0	105.3
86 Surry	62	91.3	282	85.4	84.0	76.3	79.3	73.5
87 Swain	14	115.1	40	67.7	81.2	69.8	89.4	56.0
88 Transylvania	14	49.4	112	81.2	77.3	66.3	51.9	54.7
89 Tyrrell	3	77.0	17	90.1	104.1	111.7	71.4	66.4
90 Union	49	44.5	246	48.2	115.0	69.2	79.6	68.3
91 Vance	40	95.9	232	114.2	109.7	75.8	86.0	120.9
92 Wake	264	45.9	1,233	45.9	101.6	84.7	80.1	77.7
93 Warren	22	116.3	109	119.5	114.2	111.9	104.9	88.7
94 Washington	5	38.2	35	51.8	105.9	79.5	61.5	46.9
95 Watauga	26	63.5	106	52.5	57.9	60.4	44.1	61.9
96 Wayne	87	76.8	392	70.1	132.6	112.4	90.2	89.0
97 Wilkes	58	91.6	267	85.4	76.8	87.5	85.8	83.1
98 Wilson	59	85.0	341	99.7	147.6	130.1	119.8	104.3
99 Yadkin	17	47.7	113	65.6	106.5	82.7	63.6	57.5
100 Yancey	20	120.6	81	99.6	90.2	59.3	87.9	72.8

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Cerebrovascular Disease

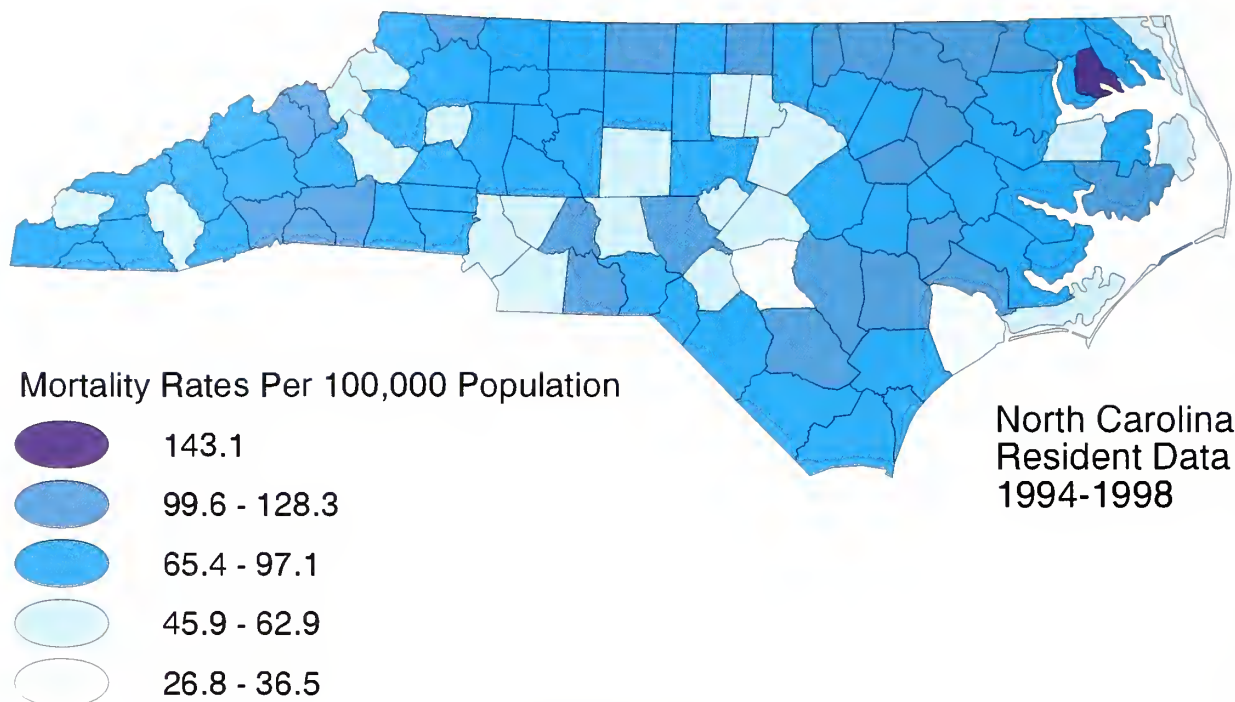


Figure 3.C

Cerebrovascular Disease

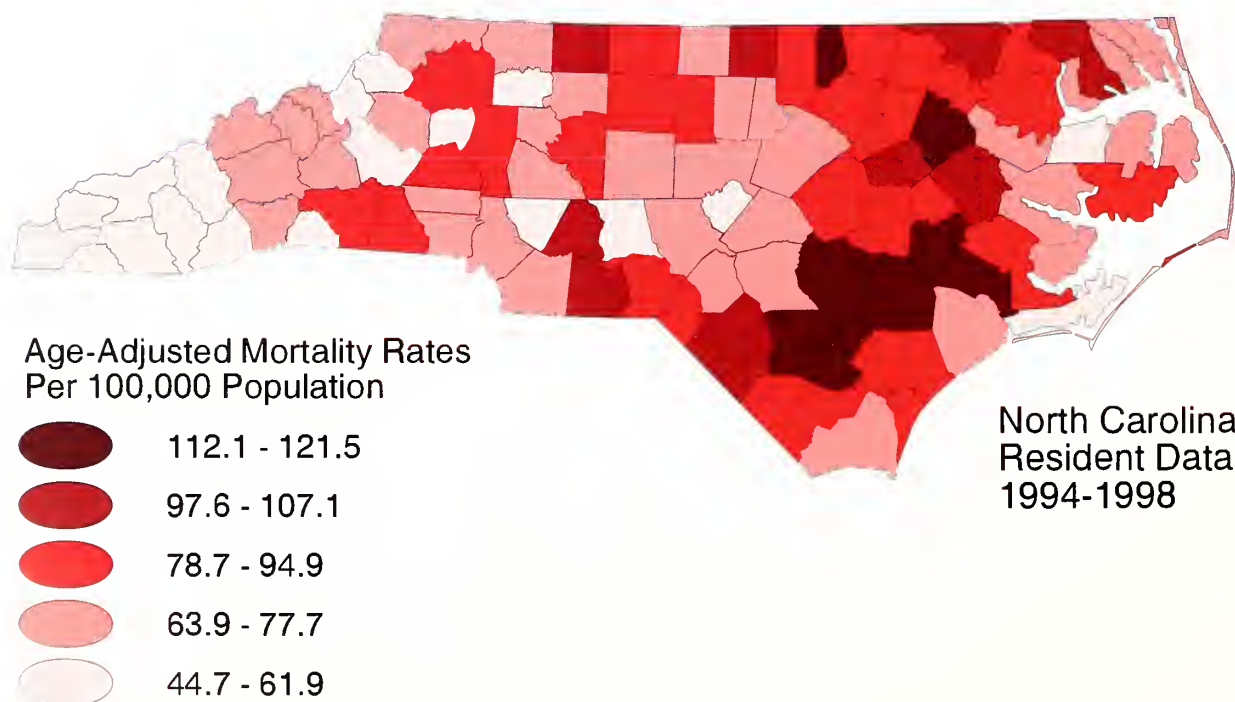


Figure 3.D

Introduction

Cancer is a group of different diseases characterized by uncontrolled growth and spread of abnormal cells. If the spread is not controlled, it can result in death. Cancer is caused by both external (chemicals, radiation, and viruses) and internal (hormones, immune conditions, and inherited mutations) factors. Causal factors may act together or in sequence to initiate or promote carcinogenesis, and often ten or more years pass between exposures or mutations and detectable cancer.

Cancer is one of the most common causes of death in North Carolina — second only to heart disease. However, while the age-adjusted death rate for heart disease has declined steadily over the past twenty years, death rates for cancer have remained relatively unchanged over time. In 1998, a total of 15,327 North Carolinians died from cancer; representing about one in five deaths in the state.

Differentials and Trends

The state's 1998 cancer death rate was 203.1 deaths per 100,000 population. The state's age-adjusted cancer death rate for 1994-98 was two percent less compared to the previous five-year period (1989-93), but still higher than the rate for 1984-88.

Comparisons of changes in the age-adjusted rates for race-sex groups also reveal small decreases over the past few years. Death from cancer is rare under the age of 35 and the number of deaths peaks in the 70-74 age group, in which 16 percent of 1997 cancer deaths occurred. Comparisons of the age-adjusted rates for race-sex groups shows higher mortality rates among males, especially minority males who have twice the overall cancer mortality rate of minority females (382.6 versus 192.1).

Risk Factors

Cancer is a number of different diseases and the risk factors vary by type. Cancer risk factors are discussed in detail in the narratives for the four major types of cancer: colon and rectum; trachea, bronchus, and lung; female breast; and prostate.

Geographic Patterns

Unadjusted and age-adjusted county cancer death rates for 1994-98 are mapped in figures 4.C and 4.D respectively. Crude mortality rates are higher in the northeastern and southwestern portions of the state. These regions, which are some of the most rural parts of the state, have limited resources to fight cancer. Without these resources, screening to detect cancer in early stages, when cancer is more easily treated, is much more difficult. Also, care after diagnosis is less likely to be effective since facilities are harder to reach, which is compounded if the cancer has been diagnosed at a later stage. This is not a new pattern. When comparing the 1994-98 unadjusted county death rates to the 1984-88 ones, the same regions and many of the same counties have higher than average mortality rates. Comparisons of the age-adjusted rates do not change this pattern. Counties in the northeastern part of the state have especially high cancer death rates (Figure 4.D).

Cancer in Special Populations

Cancer in Minorities

Cancer does not occur among all groups of individuals at the same rate. Whites comprise 79 percent of North Carolinians; all other racial groups are considered minorities. Blacks represent the largest minority population in North Carolina (although there are sizable numbers of American Indians, Asians, and Hispanics).¹

In North Carolina in 1994 through 1998, cancer was the second leading cause of death for minority males and females, with age-adjusted death rates of 382.6 and 192.1 per 100,000 population respectively.² National data show that during the 1990s, mortality rates decreased among whites, African Americans, and Hispanics; remained stable among Asian/Pacific Islanders; and increased slightly among American Indians. African-American women are more likely to die of breast and colon and rectum cancer than are women of any other racial and ethnic group. African-American men have the highest mortality rates of colon and rectum, lung and bronchus, and prostate cancer. African American men are more than twice as likely to die of prostate cancer than men of other racial and ethnic groups.³

In 1998, the five leading contributors to cancer mortality among minority males in North Carolina were: lung, prostate, colorectal, pancreas, and stomach. For minority females, breast, lung, colorectal, pancreas, and ovarian were the five leading causes of cancer deaths.

Rural Populations

Roughly one-half of all North Carolinians live in rural settings. Citizens who live in rural areas, such as Appalachia, may have less access to state-of-the-art cancer care because of their isolated residence. However, the cancer centers of the state are making efforts to reach rural citizens with the latest cancer screening and treatment services. Several medical schools in the state have research programs directed at improving services to rural areas. In addition, the National Cancer Institute has developed special programs, such as the National Appalachian Leadership Initiative in Cancer, specifically aimed to reach this population.

Other factors that may make rural populations more susceptible to cancer include different cultural or nutritional patterns and specific occupational risks such as exposure to pesticides associated with farming.

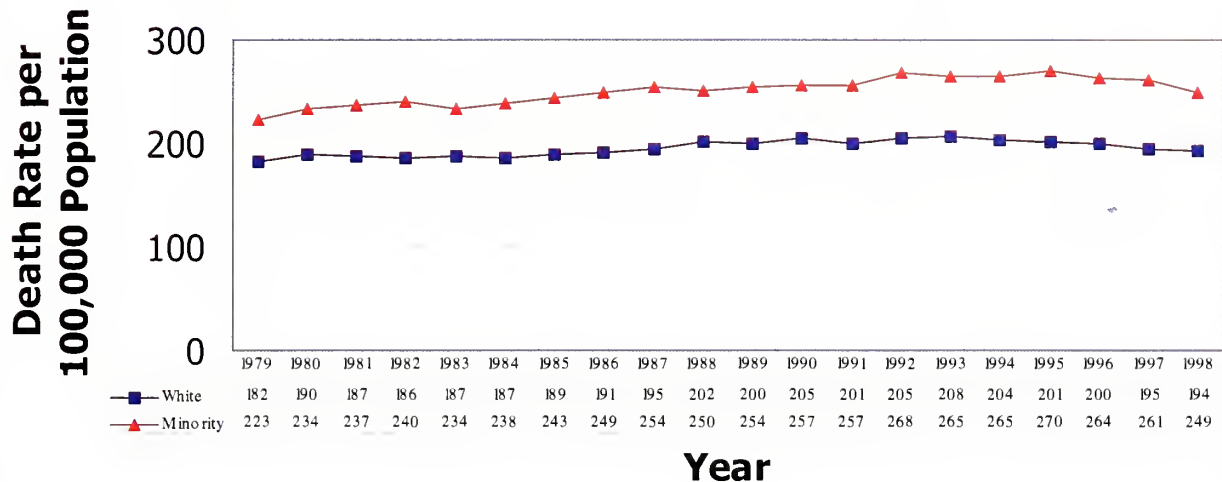
Cancer in Children

An estimated 1,600 cancer deaths are expected to occur among children ages 0-14 in 1999 in the United States, 45 in North Carolina. Despite its rarity and the fact that cancer mortality rates among children have declined 57 percent since the early 1970s, cancer is still the chief cause of death by disease in children under age 15 (deaths from injury are the highest). Approximately one-third of cancer deaths among children are from leukemia.

References

1. North Carolina Office of State Planning. July 1998 population estimates by race. Raleigh, North Carolina, 1999.
2. North Carolina Central Cancer Registry, *Cancer facts & figures – 1999*. Raleigh, North Carolina, 1999.
3. Ries LAG, Kosary CL, Hankey BF, Miller BA, Clegg L, Edwards BK (eds). *SEER cancer statistics review, 1973-1996*. National Cancer Institute, Bethesda, Maryland, 1999.

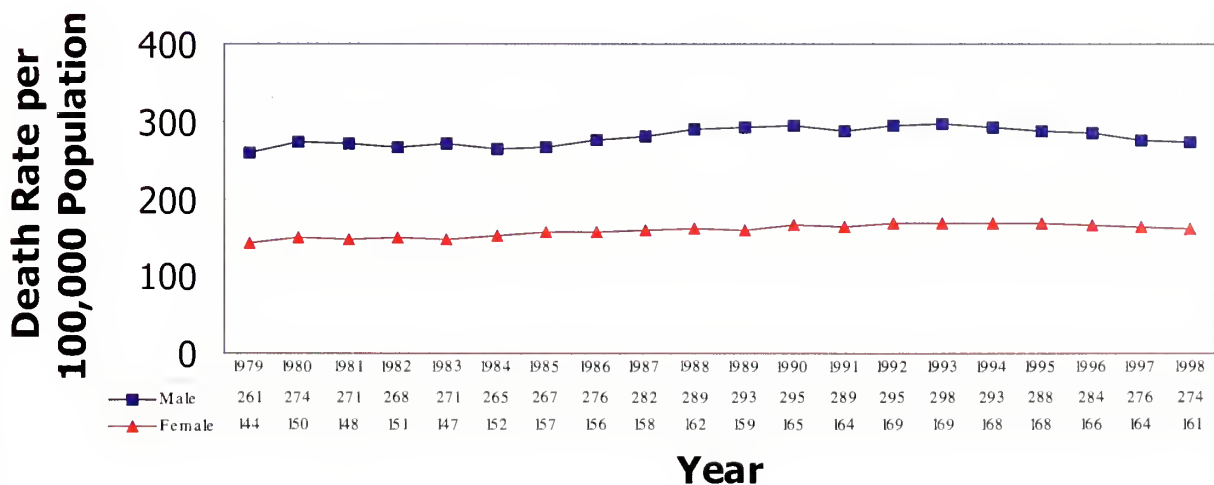
**Total Cancer:
North Carolina Resident
Age-Adjusted* Death Rates by Race 1979-1998**



*U.S. 2000 standard population

Figure 4.A

**Total Cancer:
North Carolina Resident
Age-Adjusted* Death Rates by Sex 1979-1998**



*U.S. 2000 standard population

Figure 4.B

TABLE 4
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Cancer – All Sites

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	15,327	203.1	75,094	205.4	195.6	203.1	214.2	210.1
1 Alamance	273	224.4	1,393	236.8	194.0	192.6	203.9	205.2
2 Alexander	70	219.4	288	187.8	176.7	154.0	192.2	191.0
3 Alleghany	32	324.7	160	330.8	165.2	200.1	178.4	228.3
4 Anson	54	224.8	291	243.5	165.6	182.6	207.1	210.1
5 Ashe	69	291.2	314	269.1	146.3	179.9	200.8	196.6
6 Avery	29	189.3	186	243.9	163.1	177.5	193.5	204.6
7 Beaufort	106	243.4	572	263.9	216.1	218.9	236.6	224.1
8 Bertie	50	249.6	308	302.1	240.9	225.4	250.2	274.9
9 Bladen	66	214.5	337	224.0	170.9	201.9	230.3	198.9
10 Brunswick	149	221.4	792	251.7	196.2	226.2	217.5	209.6
11 Buncombe	482	249.4	2,321	244.4	198.2	202.5	220.8	198.4
12 Burke	193	229.5	868	211.3	171.1	181.0	207.1	194.1
13 Cabarrus	237	196.4	1,169	205.7	184.4	196.8	204.2	202.6
14 Caldwell	145	192.3	764	205.8	167.3	205.4	210.4	198.2
15 Camden	20	313.6	102	323.0	242.1	221.0	201.2	298.7
16 Carteret	159	268.3	768	264.0	224.8	216.8	237.4	229.4
17 Caswell	70	312.8	299	275.6	164.2	188.4	214.5	233.9
18 Catawba	292	222.0	1,382	216.2	177.6	198.0	213.3	216.6
19 Chatham	112	243.8	480	217.9	169.9	186.1	213.0	189.0
20 Cherokee	74	324.8	308	278.6	197.2	169.0	192.1	195.7
21 Chowan	36	250.3	206	291.1	254.9	250.1	204.7	221.0
22 Clay	24	291.3	124	314.4	161.6	191.4	210.7	212.4
23 Cleveland	229	249.4	957	212.8	171.9	205.5	193.4	194.2
24 Columbus	118	226.2	616	238.5	185.9	200.1	222.3	218.5
25 Craven	201	225.8	919	211.3	233.4	204.6	223.7	230.1
26 Cumberland	408	139.4	2,115	144.1	206.0	216.6	233.6	231.9
27 Currituck	37	215.6	213	261.9	206.8	256.5	256.9	264.6
28 Dare	43	152.8	252	190.0	169.9	190.6	226.6	197.6
29 Davidson	253	179.0	1,390	200.9	184.0	194.5	192.4	199.4
30 Davie	71	220.8	316	206.5	204.3	233.2	185.5	180.7
31 Duplin	101	228.2	552	254.8	214.0	213.3	233.0	236.0
32 Durham	404	201.2	1,965	201.0	215.3	218.3	237.1	247.6
33 Edgecombe	133	243.1	669	239.5	204.1	228.5	251.9	245.9
34 Forsyth	628	216.8	3,012	212.5	194.5	196.8	212.6	212.0
35 Franklin	88	198.0	444	208.7	174.3	173.6	206.0	211.8
36 Gaston	362	200.0	2,011	224.3	193.5	201.2	216.1	229.3
37 Gates	25	250.2	130	263.6	192.1	247.5	220.9	249.1
38 Graham	17	227.8	116	310.2	181.9	223.6	188.5	236.3
39 Granville	112	251.6	477	226.2	202.3	177.7	214.6	231.0
40 Greene	29	158.1	176	203.8	200.1	177.5	186.1	195.8
41 Guilford	776	199.9	3,928	208.2	215.8	207.5	217.5	212.0
42 Halifax	129	232.8	723	256.0	203.2	199.5	226.9	238.4
43 Harnett	178	212.9	845	213.3	193.2	227.0	223.7	231.4
44 Haywood	137	265.4	653	258.6	172.3	189.5	195.0	176.9
45 Henderson	232	286.8	1,163	299.0	177.7	187.1	206.0	192.3
46 Hertford	58	269.0	308	278.5	198.6	217.6	253.4	250.1
47 Hoke	44	146.5	224	158.8	169.9	191.1	264.0	203.6
48 Hyde	12	209.0	63	236.0	156.1	225.1	247.1	194.2
49 Iredell	223	196.4	1,133	212.5	171.5	188.5	204.0	202.8
50 Jackson	74	250.4	320	220.5	170.8	178.4	189.5	194.8

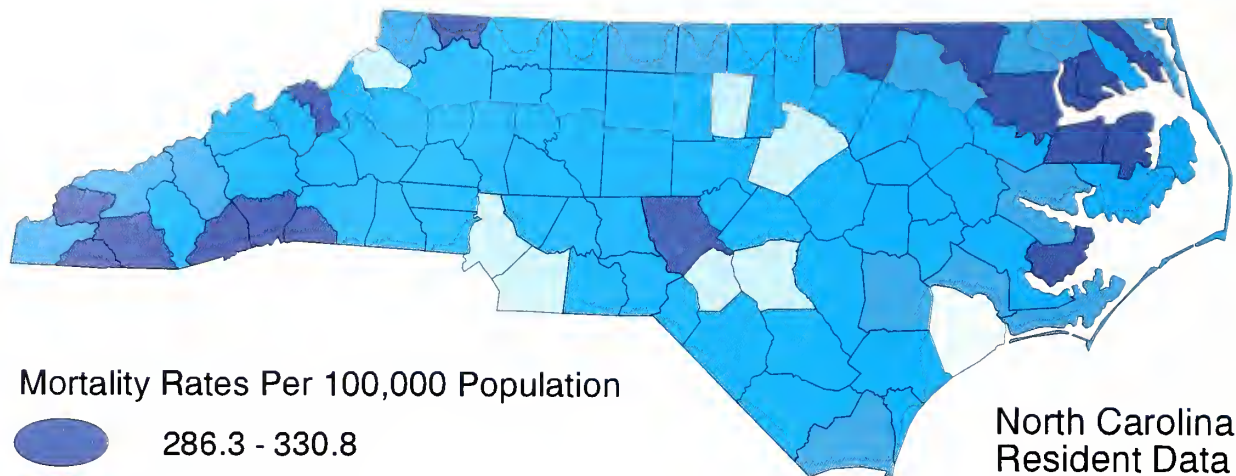
*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 4 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Cancer – All Sites

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	230	213.5	1,050	211.2	209.4	194.2	202.9	215.1
52 Jones	29	313.0	129	277.0	180.4	198.8	161.9	246.1
53 Lee	107	219.5	534	226.9	224.8	202.3	222.2	215.0
54 Lenoir	137	233.8	713	242.0	217.5	216.4	233.9	219.7
55 Lincoln	119	201.4	532	187.2	183.6	187.2	211.7	192.8
56 McDowell	102	254.3	453	236.2	168.8	190.5	202.6	203.0
57 Macon	69	245.1	399	296.4	194.9	192.4	181.9	182.3
58 Madison	39	207.5	217	239.3	178.4	184.2	172.4	186.6
59 Martin	63	245.8	317	245.9	208.5	201.2	239.3	216.2
60 Mecklenburg	970	155.3	4,738	159.8	208.0	209.9	219.5	206.3
61 Mitchell	46	314.5	212	289.2	186.8	194.3	215.0	209.9
62 Montgomery	62	250.8	261	215.5	203.8	190.5	211.1	213.5
63 Moore	215	303.6	1,016	298.8	216.1	215.9	204.3	199.1
64 Nash	176	199.7	873	204.0	202.0	201.9	223.6	207.5
65 New Hanover	301	202.9	1,464	205.3	223.4	244.6	245.1	201.9
66 Northampton	52	250.6	310	298.8	221.2	227.9	221.0	233.4
67 Onslow	169	113.4	789	106.4	208.0	223.8	233.6	233.6
68 Orange	181	165.6	787	147.6	183.0	206.5	205.4	205.2
69 Pamlico	43	355.5	177	296.3	208.8	230.9	245.5	218.6
70 Pasquotank	68	195.6	386	227.4	218.7	242.9	226.4	218.1
71 Pender	85	223.0	407	226.7	232.0	224.7	213.2	201.8
72 Perquimans	35	319.7	165	306.6	212.8	184.5	218.6	227.6
73 Person	70	210.2	375	231.2	191.1	184.2	209.8	208.7
74 Pitt	203	160.3	1,088	180.2	217.9	213.2	233.5	230.3
75 Polk	45	270.0	254	315.6	175.6	190.9	201.4	184.5
76 Randolph	233	187.7	1,166	196.7	172.6	190.3	200.8	196.9
77 Richmond	98	215.4	520	228.6	198.0	195.5	223.0	212.5
78 Robeson	216	188.8	1,107	197.7	192.8	201.9	215.2	230.0
79 Rockingham	243	271.1	1,153	259.6	191.2	197.2	220.6	228.1
80 Rowan	289	231.7	1,411	233.5	180.1	196.0	215.5	204.7
81 Rutherford	152	253.1	707	238.5	176.9	187.6	198.4	201.9
82 Sampson	122	228.8	617	239.3	204.9	195.2	201.3	214.8
83 Scotland	58	164.8	346	198.2	182.8	220.2	224.5	218.4
84 Stanly	117	210.4	642	235.3	179.8	195.7	191.0	210.7
85 Stokes	96	222.2	410	195.7	185.1	187.3	217.2	199.2
86 Surry	185	272.3	802	243.0	194.2	182.5	190.2	204.3
87 Swain	28	230.1	154	260.7	188.2	206.6	202.7	218.8
88 Transylvania	94	332.0	396	287.1	186.5	197.1	197.0	197.9
89 Tyrrell	8	205.4	54	286.3	229.8	217.6	179.2	218.0
90 Union	182	165.3	870	170.3	178.7	204.0	208.9	208.9
91 Vance	118	283.0	523	257.4	196.7	231.9	244.1	258.8
92 Wake	760	132.2	3,580	133.3	205.3	203.7	203.6	196.0
93 Warren	65	343.6	270	295.9	232.3	247.0	238.7	223.0
94 Washington	54	412.1	214	316.8	221.7	259.1	246.1	283.0
95 Watauga	69	168.6	318	157.6	169.6	164.1	170.1	177.0
96 Wayne	247	218.0	1,105	197.7	188.7	232.1	231.0	226.4
97 Wilkes	142	224.3	649	207.7	183.3	167.5	186.3	188.4
98 Wilson	161	232.0	763	223.2	214.1	219.4	238.6	218.8
99 Yadkin	80	224.4	370	214.9	166.8	185.9	195.5	183.2
100 Yancey	30	180.9	179	220.2	165.8	212.4	158.2	163.2

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Cancer - All Sites



Mortality Rates Per 100,000 Population

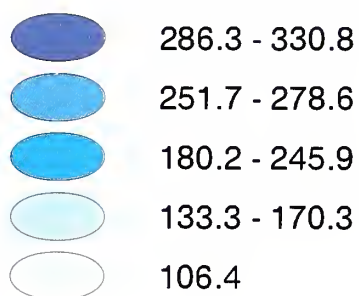
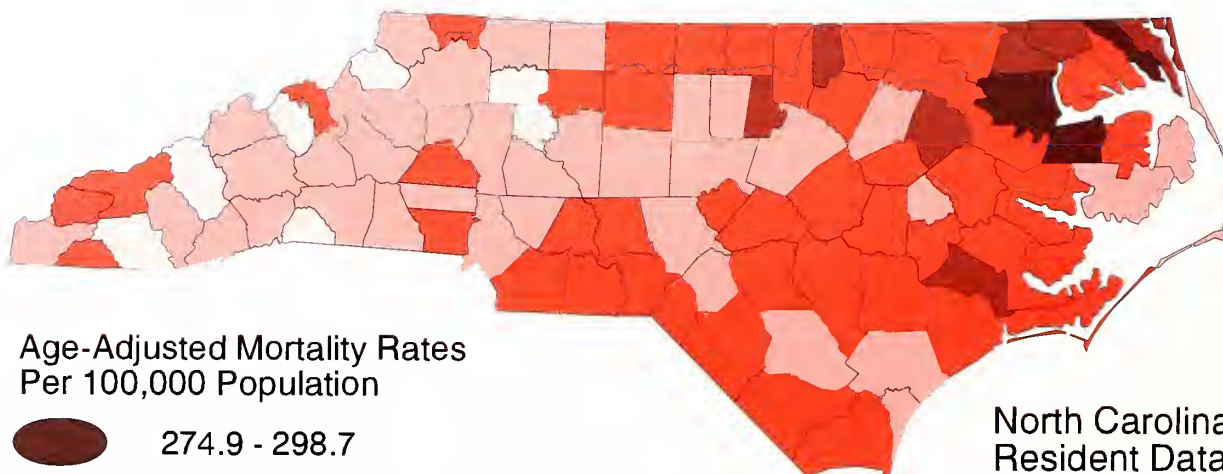


Figure 4.C

Cancer - All Sites



Age-Adjusted Mortality Rates
Per 100,000 Population

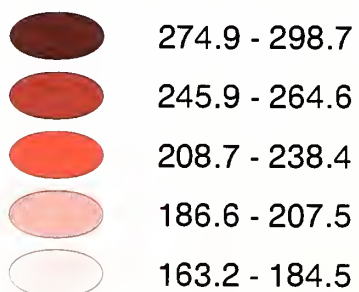


Figure 4.D

Cancer of the Colon & Rectum

Introduction

In 1998, a total of 1,517 North Carolinians died of colorectal cancer. This accounted for 9.9 percent of the state's total cancer deaths and 2.2 percent of all resident deaths. The 1998 age-adjusted mortality rate for colon and rectal cancer was 20.4 deaths per 100,000 population. During the five-year period 1994-1998, colon and rectum cancer ranked second among cancer deaths in North Carolina. During this same time period, colon and rectum cancer was among the top ten leading causes of death in North Carolina.

Differentials and Trends

The five-year age-adjusted mortality rate during 1994-1998 was 4.5 percent lower than the 1984-1988 rate. During this time period (1994-1998), minority males had the highest age-adjusted mortality rate of 31.7 deaths per 100,000 population followed by minority females at 25.2 deaths per 100,000 population. During this same time period, white females experienced the lowest age-adjusted mortality rate of 16.9 deaths per 100,000 population, while white males had a rate of 24.4 deaths per 100,000 population.

There is a wide sex differential in mortality for colorectal cancer. During 1994-1998, North Carolina's age-adjusted death rate was 44.4 percent higher for white males than for white females and 25.8 percent higher for minority males than for minority females. There is also a sizeable difference in age-adjusted death rates for racial groups. The 1994-1998 minority male rate was 29.9 percent higher than that for white males, while the minority female rate was 49.1 percent higher than the rate for white females.

In North Carolina, colorectal cancer deaths do not generally occur prior to age 45, with the colorectal cancer mortality rate peaking at ages 75+. The same is true for colorectal cancer incidence rates for North Carolina.

Colorectal cancer is the third most common malignancy in terms of new cases and deaths among men and women in the United States. The incidence rates for colorectal cancer have declined noticeably in the 1990's. The risk of developing colorectal cancer increases with age in men and women; however, at all ages, men are more likely to develop colorectal cancer than women. Men are also more likely to die from colorectal cancer than women.¹ Among North Carolina residents, there will be a projected 4,350 new colorectal cases in 1999.²

When colorectal cancer is detected in an early, local stage, the 5-year relative survival rate is 90 percent. After the cancer has spread regionally to involve adjacent organs or lymph nodes, the survival rate drops to 65 percent, while the rate for persons with distant metastases is around 8 percent.¹ In North Carolina, approximately 35 percent of colorectal cases are diagnosed at the early stage.

Risk Factors

Inadequate nutrition is thought to be one of the greatest risk factors for developing colorectal cancer. While there is no recognized way to prevent colorectal cancer, it is thought that people can reduce their risk by eating a nutritious diet – particularly one that is low in fat and high in fiber. Dietary factors that are thought to play a protective role against the development of colorectal cancer include consuming high-fiber foods (fruits, vegetables, beans, legumes, and grains), cruciferous vegetables (cabbage, broccoli, cauliflower, and brussels sprouts), and vitamins A and C.³

Other risk factors that have been associated with an increased risk of colorectal cancer are physical inactivity and a family history of colorectal cancer or polyps.⁴

Like many other cancers, failure to have timely and appropriate screening also increases the risk of colorectal cancer death. It is recommended that beginning at age 50, men and women have cancer screening tests performed such as: digital rectal examination, fecal occult blood test, sigmoidoscopy, colonoscopy, or double-contrast barium enema.⁴ These tests have resulted in a reduction in the number of deaths from colorectal cancer, by detecting and removing adenomatous polyps before these become cancers or by detecting and removing early stage colorectal cancers when the disease is still highly curable. However, a larger fraction of colorectal cancers could be prevented by appropriate modifications in diet and the adoption of regular physical activity.

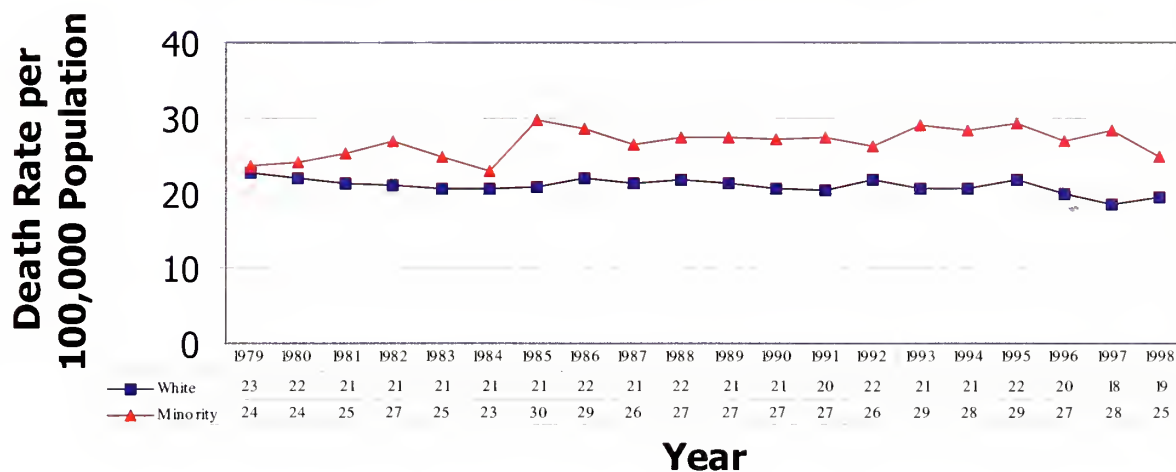
Geographic Patterns

As shown in the unadjusted mortality rate map, higher mortality rates tend to be found in the northeastern part of North Carolina. The high unadjusted mortality rates found in the northeast are especially evident in counties such as Northampton, Hertford, Bertie, Chowan, and Gates. Age-adjusted colorectal cancer mortality rates were also higher in the northeast during the five-year period (1994-1998). Higher mortality rates in this region could be associated with poor screening (screening at later stages) and insufficient access to health care in this region compared with other parts of the state.

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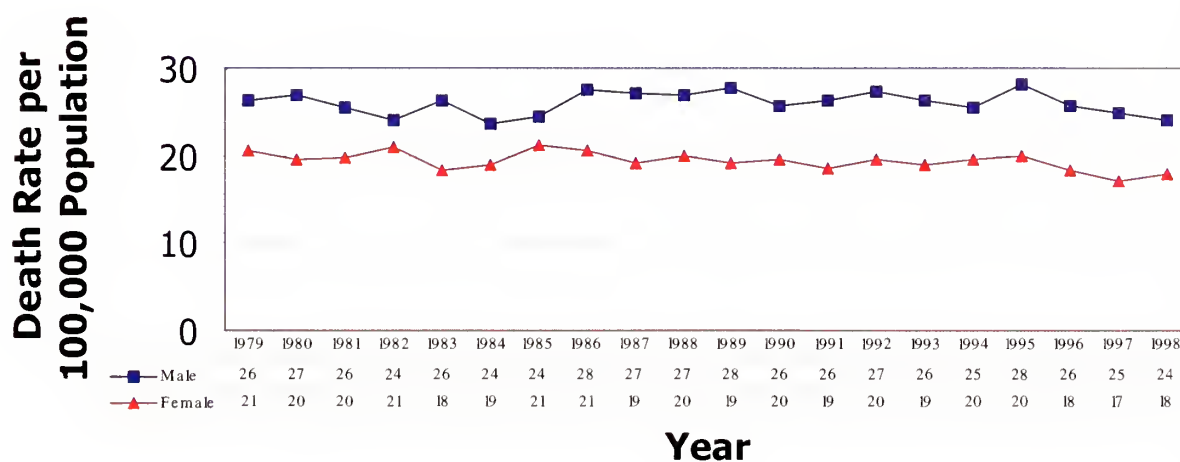
Colorectal Cancer: North Carolina Resident Age-Adjusted* Death Rates by Race 1979-1998



*U.S. 2000 standard population

Figure 5.A

Colorectal Cancer: North Carolina Resident Age-Adjusted* Death Rates by Sex 1979-1998



*U.S. 2000 standard population

Figure 5.B

TABLE 5
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Cancer – Colon, Rectum, and Anus

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	1,517	20.1	7,518	20.6	22.2	22.3	22.1	21.3
1 Alamance	23	18.9	140	23.8	20.0	22.9	21.2	20.9
2 Alexander	6	18.8	28	18.3	12.5	26.8	20.6	18.4
3 Alleghany	5	50.7	20	41.3	18.7	15.8	14.1	27.2
4 Anson	7	29.1	41	34.3	17.0	14.5	23.0	28.9
5 Ashe	5	21.1	27	23.1	17.0	14.0	18.6	16.7
6 Avery	6	39.2	14	18.4	7.4	21.9	26.1	15.0
7 Beaufort	10	23.0	50	23.1	23.9	19.0	19.7	19.9
8 Bertie	7	34.9	35	34.3	36.0	23.9	30.7	31.5
9 Bladen	9	29.2	40	26.6	13.9	22.0	22.6	24.1
10 Brunswick	12	17.8	89	28.3	16.6	23.6	21.9	23.2
11 Buncombe	50	25.9	235	24.7	22.1	20.8	23.6	19.9
12 Burke	24	28.5	84	20.4	23.0	18.6	22.9	19.1
13 Cabarrus	16	13.3	106	18.7	21.6	23.7	19.9	18.4
14 Caldwell	10	13.3	66	17.8	21.5	18.3	20.7	17.1
15 Camden	4	62.7	9	28.5	18.9	31.5	23.1	26.2
16 Carteret	9	15.2	66	22.7	22.4	26.7	22.5	20.3
17 Caswell	4	17.9	30	27.7	12.1	21.0	28.4	23.5
18 Catawba	36	27.4	165	25.8	21.3	24.7	25.0	26.2
19 Chatham	9	19.6	52	23.6	19.8	23.9	20.0	20.8
20 Cherokee	10	43.9	29	26.2	15.5	15.5	18.8	19.1
21 Chowan	1	7.0	24	33.9	31.3	26.2	39.0	25.0
22 Clay	1	12.1	12	30.4	20.1	23.6	18.6	20.2
23 Cleveland	26	28.3	88	19.6	25.3	25.3	22.7	17.9
24 Columbus	11	21.1	49	19.0	12.7	15.6	20.5	18.2
25 Craven	15	16.9	100	23.0	25.0	21.0	21.4	25.8
26 Cumberland	30	10.2	151	10.3	23.0	23.6	24.9	17.3
27 Currituck	5	29.1	21	25.8	30.5	25.2	18.6	29.3
28 Dare	3	10.7	20	15.1	27.5	28.8	19.6	17.0
29 Davidson	25	17.7	130	18.8	20.7	17.9	20.2	18.9
30 Davie	5	15.5	37	24.2	26.5	27.0	27.7	21.4
31 Duplin	14	31.6	64	29.5	18.6	18.8	25.5	27.0
32 Durham	34	16.9	197	20.2	22.5	24.7	23.3	24.8
33 Edgecombe	17	31.1	72	25.8	25.3	23.1	23.4	26.5
34 Forsyth	72	24.9	316	22.3	23.8	21.9	21.1	22.3
35 Franklin	7	15.8	53	24.9	18.7	17.8	20.0	25.2
36 Gaston	39	21.5	200	22.3	21.8	20.7	21.3	23.2
37 Gates	2	20.0	20	40.6	31.5	23.8	23.8	37.8
38 Graham	3	40.2	11	29.4	21.3	22.5	18.0	23.6
39 Granville	9	20.2	44	20.9	19.1	24.1	19.1	21.2
40 Greene	3	16.4	14	16.2	16.9	16.5	23.7	15.9
41 Guilford	70	18.0	389	20.6	23.7	23.0	22.9	21.2
42 Halifax	16	28.9	81	28.7	22.9	18.2	24.6	26.6
43 Harnett	20	23.9	100	25.2	23.4	21.8	21.7	27.8
44 Haywood	10	19.4	57	22.6	18.7	20.0	18.7	15.4
45 Henderson	28	34.6	123	31.6	22.0	24.4	23.6	20.5
46 Hertford	6	27.8	36	32.6	29.8	27.9	31.5	29.2
47 Hoke	4	13.3	23	16.3	23.1	15.2	31.5	20.2
48 Hyde	2	34.8	9	33.7	10.2	20.7	22.1	28.5
49 Iredell	25	22.0	118	22.1	21.1	22.6	25.2	21.6
50 Jackson	10	33.8	28	19.3	11.4	12.5	18.4	17.6

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 5 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Cancer – Colon, Rectum, and Anus

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	18	16.7	93	18.7	26.3	14.2	19.9	19.4
52 Jones	3	32.4	15	32.2	15.3	21.9	20.7	28.5
53 Lee	8	16.4	55	23.4	24.9	22.1	18.8	22.6
54 Lenoir	19	32.4	102	34.6	18.8	28.3	24.4	32.2
55 Lincoln	15	25.4	58	20.4	24.0	26.1	29.1	21.4
56 McDowell	19	47.4	54	28.2	19.3	20.8	17.6	24.7
57 Macon	4	14.2	41	30.5	21.4	26.5	15.0	18.0
58 Madison	4	21.3	17	18.7	16.3	12.8	10.8	15.0
59 Martin	6	23.4	40	31.0	16.6	23.8	26.5	26.9
60 Mecklenburg	81	13.0	447	15.1	24.3	23.5	19.7	20.0
61 Mitchell	4	27.4	19	25.9	17.9	22.5	20.7	18.4
62 Montgomery	11	44.5	32	26.4	24.0	30.2	20.0	26.4
63 Moore	18	25.4	118	34.7	29.3	24.6	23.2	23.4
64 Nash	21	23.8	87	20.3	27.1	18.9	20.1	20.9
65 New Hanover	27	18.2	124	17.4	25.7	33.6	25.5	17.5
66 Northampton	11	53.0	38	36.6	29.4	21.1	28.9	29.7
67 Onslow	15	10.1	76	10.2	21.0	26.8	26.6	23.8
68 Orange	22	20.1	78	14.6	21.4	23.5	20.2	20.5
69 Pamlico	4	33.1	14	23.4	26.1	37.2	20.6	17.5
70 Pasquotank	5	14.4	50	29.5	22.5	32.1	26.0	27.9
71 Pender	6	15.7	33	18.4	21.8	21.8	21.9	16.2
72 Perquimans	2	18.3	14	26.0	21.3	28.8	19.4	18.9
73 Person	9	27.0	54	33.3	11.7	15.6	18.0	30.5
74 Pitt	18	14.2	109	18.1	22.2	21.1	24.5	23.3
75 Polk	8	48.0	36	44.7	25.7	22.7	18.6	24.8
76 Randolph	23	18.5	104	17.5	23.0	25.3	23.0	17.8
77 Richmond	10	22.0	68	29.9	24.6	19.0	26.7	27.6
78 Robeson	22	19.2	102	18.2	17.9	21.0	21.8	21.9
79 Rockingham	24	26.8	110	24.8	21.6	17.1	22.1	21.9
80 Rowan	23	18.4	126	20.9	25.3	23.6	22.3	18.2
81 Rutherford	15	25.0	75	25.3	23.0	21.6	24.4	21.4
82 Sampson	14	26.3	66	25.6	25.3	20.3	23.0	23.2
83 Scotland	5	14.2	41	23.5	15.0	17.7	23.2	25.9
84 Stanly	13	23.4	80	29.3	22.3	26.7	15.2	26.2
85 Stokes	10	23.1	37	17.7	14.0	14.4	12.3	18.8
86 Surry	19	28.0	78	23.6	21.6	19.8	15.8	20.1
87 Swain	2	16.4	11	18.6	26.7	23.1	25.9	15.9
88 Transylvania	8	28.3	32	23.2	23.9	19.1	27.1	17.4
89 Tyrrell	1	25.7	7	37.1	39.6	27.8	38.8	29.1
90 Union	18	16.3	81	15.9	18.8	25.8	21.1	20.0
91 Vance	12	28.8	46	22.6	21.5	26.4	25.5	23.1
92 Wake	72	12.5	356	13.3	21.3	25.0	20.1	20.1
93 Warren	6	31.7	26	28.5	28.8	16.1	30.8	21.3
94 Washington	6	45.8	19	28.1	27.9	30.9	37.1	25.6
95 Watauga	3	7.3	27	13.4	22.0	14.0	20.2	15.4
96 Wayne	27	23.8	105	18.8	22.6	26.4	28.1	22.3
97 Wilkes	20	31.6	61	19.5	21.0	18.4	20.6	17.7
98 Wilson	21	30.3	73	21.4	21.2	18.2	20.9	21.3
99 Yadkin	7	19.6	48	27.9	19.5	18.1	18.7	23.9
100 Yancey	3	18.1	22	27.1	19.0	20.2	16.8	19.9

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Cancer - Colon, Rectum and Anus

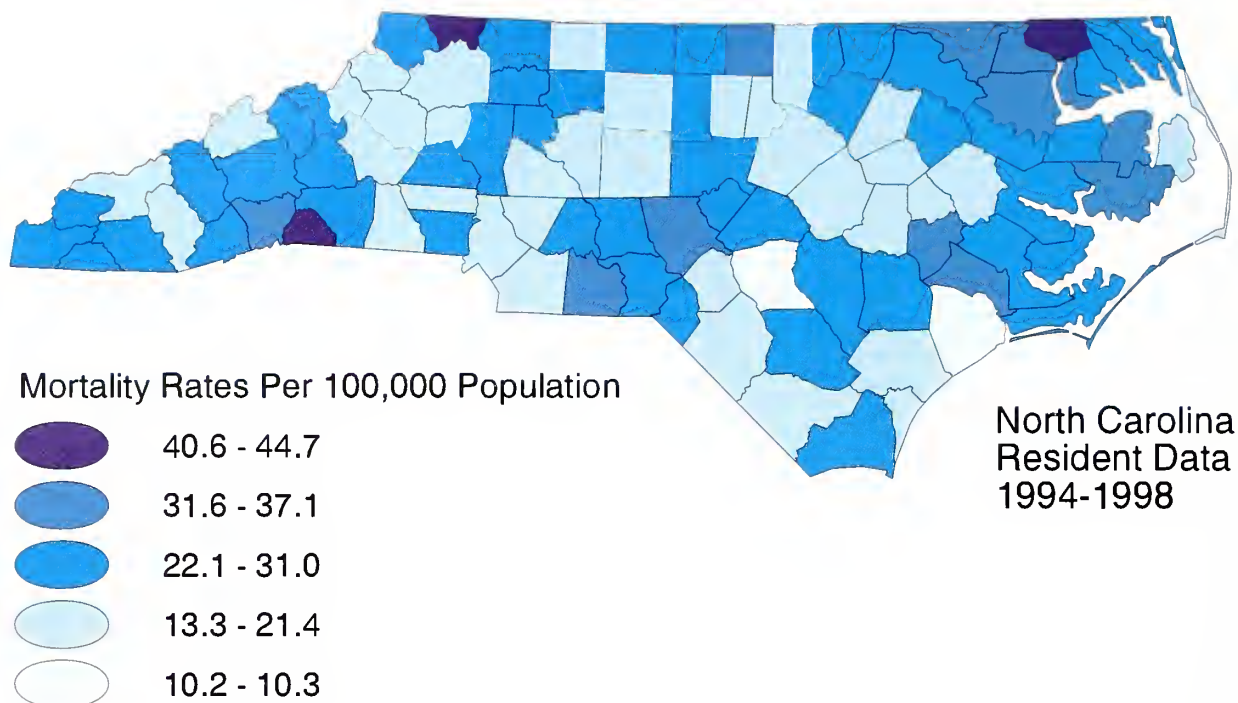


Figure 5.C

Cancer - Colon, Rectum and Anus

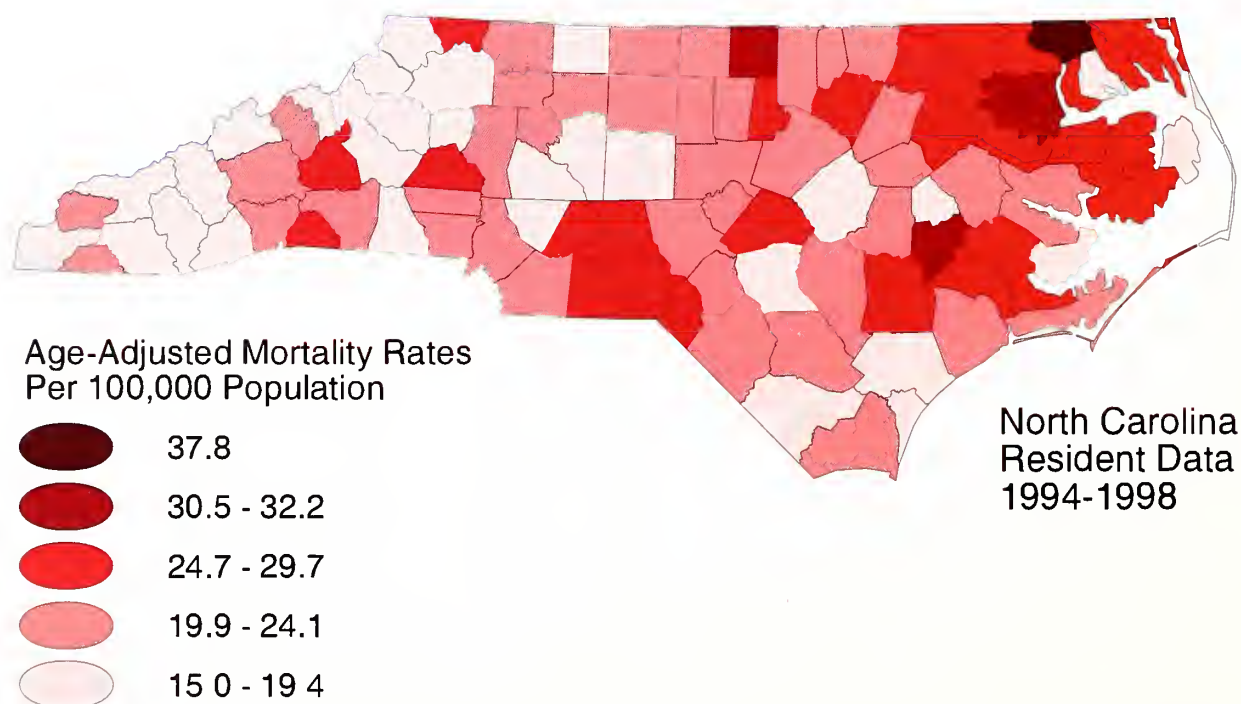


Figure 5.D

Cancer of the Trachea, Bronchus, & Lung

Introduction

Lung cancer continues to be the leading cause of cancer death for both men and women in the United States. In 1999, an estimated 160,000 people (mostly ages 50 and over) died in the United States of lung cancer: over 94,000 men and about 66,000 women, more deaths than from breast, prostate, and colorectal cancer combined.¹

Differentials and Trends

In 1998 a total of 4,692 North Carolinians died from lung cancer. This accounted for 30.6 percent of the state's cancer deaths and 6.9 percent of all deaths. Although lung cancer has long been the leading cause of cancer death among men, it became the leading cause of cancer death among women in North Carolina in 1990, exceeding breast cancer. In North Carolina, the age-adjusted mortality rate in 1994-1998 was 62.6 per 100,000 population. This represented a 14 percent increase over the 1984-88 rate and 2 percent increase over the 1989-93 mortality rate.

In every ethnic group, men have much higher lung cancer incidence and mortality rates than women. In 1993-1997, North Carolina minority males had the highest age-adjusted incidence rate followed by white males, white females, and minority females. African-American men have the highest lung cancer incidence and mortality rates. The American Cancer Society estimates approximately 171,600 new cases of lung cancer will be diagnosed in the United States in 1999. That is about 13 percent of all newly diagnosed cancers.¹ North Carolina projects 5,295 new lung cancer cases in 1999. The incidence and mortality rates, which until recently had been increasing steadily for both sexes, are now decreasing among men but continue to increase among women. This decline in lung cancer mortality represents more than half of the overall drop in cancer mortality among men over the past several years. North Carolina incidence rates are quite similar to those of the nation at large.

Early detection is very difficult because symptoms often do not appear until the disease is in an advanced stage. For those who stop smoking when pre-cancerous changes are found, damaged lung tissue often returns to normal. Chest x-ray, analysis of cells contained in sputum, and fiberoptic examination of the bronchial passage assist diagnosis. Warning signals include persistent cough, sputum streaked with blood, chest pain, and recurring pneumonia or bronchitis.

The one-year relative survival rate for lung cancer has increased from 32 percent in 1973 to 41 percent in 1996, largely due to improvements in surgical techniques. The 5-year survival rate for lung cancer is only 14 percent in all patients for all stages combined. For African Americans diagnosed during 1989-1995, the 5-year survival rate was only 11 percent, compared to 14 percent for whites. The survival rate is 49 percent for cases detected early when the disease is still localized, but only 19 percent of lung cancers in North Carolina residents are discovered early. Overall, lung cancer 5-year relative survival rates are very low.²

Lung cancer is the leading cause of cancer death in African Americans, and is expected to cause 10,500 deaths in men and 6,000 deaths in women in 1999 in the United States. African-American men have had consistently high lung cancer incidence and mortality rates since the 1970's. However, during 1995-1996, lung cancer death rates in African-American men decreased on average 1.8

percent per year while rates in women appeared to be increasing slightly (0.2 percent per year). Mortality and incidence rates from lung cancer are higher for African-American men than for white men, even though African-American men begin smoking at an older age and smoke fewer cigarettes per day.³

Risk Factors

Eighty-seven percent of lung cancer cases are smoking-related.⁴ In past decades, cigarette smoking was very common among United States men. In 1955, nearly 60 percent of men were smokers. By the end of the 1960s, however, male smoking had dropped to less than 45 percent and this trend continued over the next two decades. As a result of this temporal pattern in smoking, and the lag time reflecting the carcinogenic process, lung cancer mortality among men peaked in the early 1990s. The subsequent decline in lung cancer mortality among men reflects the success of tobacco control efforts over the past three decades, resulting in decreased smoking rates among men over the last 30 years. However, the smoking patterns of women lag behind those of men. As a result, the lung cancer mortality rates are still rising among women.² Smoking among teens and young adults has increased in recent years in North Carolina⁵ and this could result in higher lung cancer death rates in the future.

While cigarette smoking is the predominant risk factor for lung cancer, passive exposure to cigarette smoke increases the risk for nonsmokers. Other risk factors include exposure to certain industrial substances (such as arsenic); some organic chemicals; radioactive gas; asbestos; radiation exposure from occupational, medical, and environmental sources; air pollution; and tuberculosis.⁴

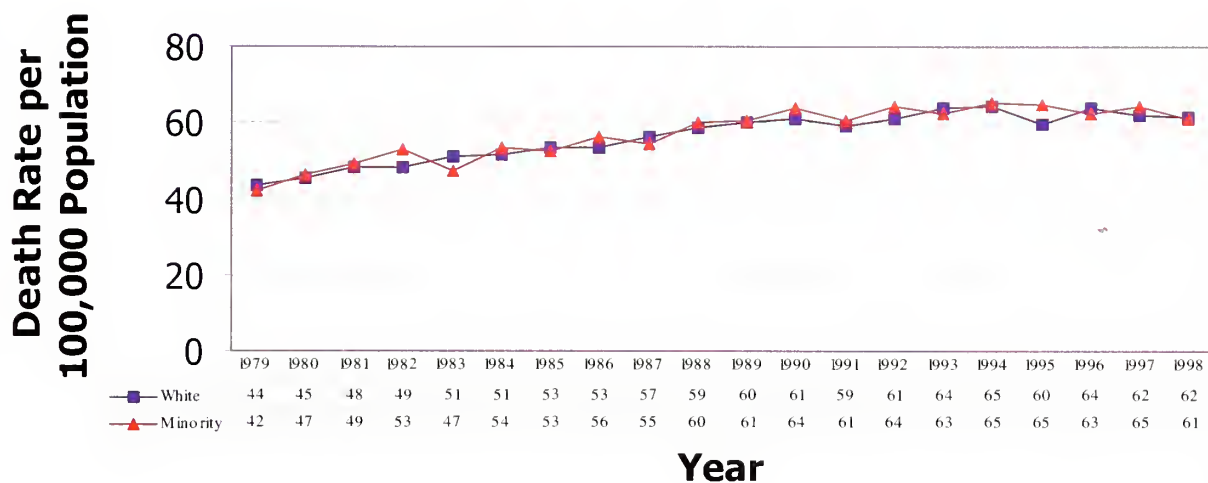
Geographic Patterns

During 1994-1998, residents of eastern North Carolina experienced generally higher lung cancer mortality than other parts of the state (Figures 6.C and 6.D) with moderate rates for some contiguous counties. Users should consult these maps to ascertain a county's relative level of unadjusted and age-adjusted mortality from lung cancer.

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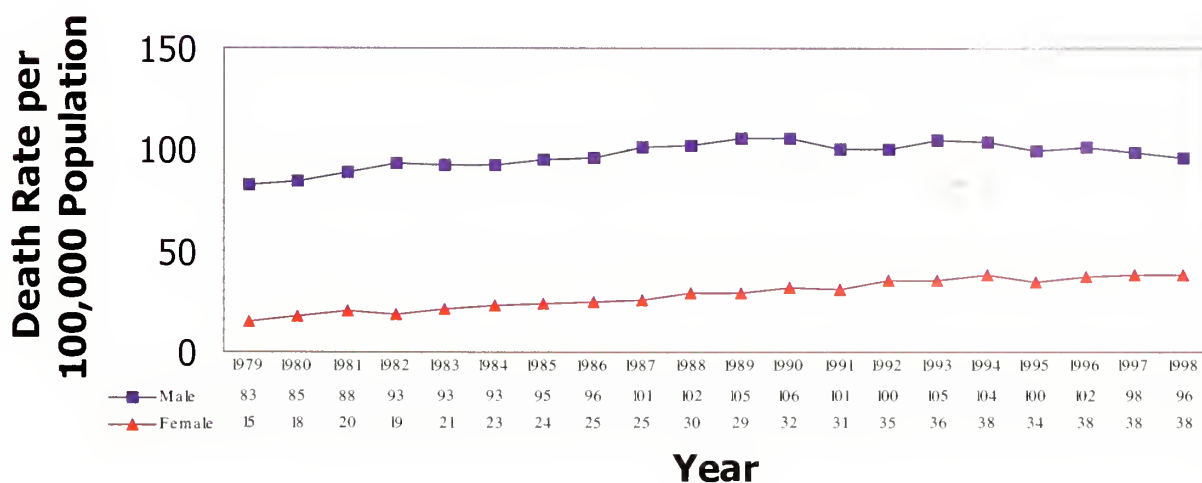
Lung Cancer: North Carolina Resident Age-Adjusted* Death Rates by Race 1979-1998



*U.S. 2000 standard population

Figure 6.A

Lung Cancer: North Carolina Resident Age-Adjusted* Death Rates by Sex 1979-1998



*U.S. 2000 standard population

Figure 6.B

TABLE 6
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Cancer – Trachea, Bronchus, and Lung

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	4,692	62.2	22,787	62.3	47.6	54.9	61.4	62.6
1 Alamance	89	73.2	445	75.6	47.1	51.7	60.1	64.5
2 Alexander	25	78.4	88	57.4	45.5	35.8	47.4	57.1
3 Alleghany	6	60.9	36	74.4	47.2	61.6	61.6	50.8
4 Anson	14	58.3	68	56.9	45.1	54.6	63.6	49.0
5 Ashe	18	76.0	94	80.6	33.1	48.8	57.6	57.8
6 Avery	6	39.2	59	77.4	37.0	63.1	67.1	64.7
7 Beaufort	40	91.9	216	99.7	54.9	57.5	70.3	83.9
8 Bertie	14	69.9	85	83.4	52.9	56.8	74.5	75.1
9 Bladen	21	68.2	99	65.8	57.9	58.5	67.4	57.5
10 Brunswick	45	66.9	266	84.5	47.6	72.4	69.0	66.0
11 Buncombe	150	77.6	684	72.0	45.7	56.0	62.8	58.3
12 Burke	62	73.7	277	67.4	40.6	49.2	58.9	60.4
13 Cabarrus	68	56.4	339	59.6	41.1	52.7	55.5	57.4
14 Caldwell	51	67.6	256	69.0	44.3	53.1	66.2	64.8
15 Camden	3	47.0	30	95.0	53.2	57.2	64.0	82.1
16 Carteret	54	91.1	252	86.6	65.8	66.2	74.9	72.7
17 Caswell	27	120.6	90	83.0	42.5	44.7	60.9	70.2
18 Catawba	79	60.1	421	65.9	40.8	54.7	64.4	64.5
19 Chatham	25	54.4	126	57.2	33.6	57.0	44.1	48.7
20 Cherokee	20	87.8	97	87.7	41.6	50.2	62.9	61.1
21 Chowan	9	62.6	66	93.3	65.2	62.1	49.8	70.6
22 Clay	8	97.1	30	76.1	40.7	38.0	54.4	51.2
23 Cleveland	67	73.0	282	62.7	35.7	51.9	54.0	55.9
24 Columbus	40	76.7	199	77.1	47.9	60.9	76.5	68.9
25 Craven	70	78.6	282	64.8	63.8	48.7	63.8	67.1
26 Cumberland	146	49.9	721	49.1	53.3	66.1	75.5	76.4
27 Currituck	11	64.1	81	99.6	68.2	87.8	75.9	95.7
28 Dare	18	64.0	90	67.9	43.8	58.1	89.5	69.9
29 Davidson	83	58.7	467	67.5	43.3	49.0	54.6	65.1
30 Davie	20	62.2	88	57.5	47.0	44.7	43.7	48.5
31 Duplin	23	52.0	165	76.2	54.1	54.9	65.2	69.1
32 Durham	118	58.8	586	59.9	52.6	56.3	69.0	74.5
33 Edgecombe	29	53.0	182	65.2	53.9	61.5	73.2	66.1
34 Forsyth	181	62.5	880	62.1	44.5	50.9	60.4	61.5
35 Franklin	26	58.5	130	61.1	48.9	56.9	63.2	61.8
36 Gaston	122	67.4	682	76.1	48.9	61.2	65.4	76.0
37 Gates	3	30.0	26	52.7	56.3	76.2	62.4	50.4
38 Graham	6	80.4	39	104.3	57.7	71.6	63.4	77.3
39 Granville	31	69.6	144	68.3	42.4	46.9	62.4	68.8
40 Greene	4	21.8	53	61.4	49.9	68.8	51.9	58.0
41 Guilford	228	58.7	1,156	61.3	55.7	55.1	65.5	61.4
42 Halifax	38	68.6	205	72.6	46.9	55.6	62.0	66.5
43 Harnett	61	73.0	246	62.1	49.3	56.1	67.7	65.9
44 Haywood	38	73.6	206	81.6	36.3	51.1	55.9	54.2
45 Henderson	72	89.0	348	89.5	38.4	46.1	58.1	55.9
46 Hertford	15	69.6	103	93.1	45.1	60.9	66.6	82.7
47 Hoke	12	39.9	61	43.3	41.8	64.9	73.5	54.3
48 Hyde	3	52.3	21	78.7	54.7	63.9	75.4	64.0
49 Iredell	75	66.1	351	65.8	36.9	47.2	52.8	61.7
50 Jackson	18	60.9	98	67.5	42.4	42.4	45.9	58.6

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 6 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Cancer – Trachea, Bronchus, and Lung

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	75	69.6	351	70.6	50.0	55.6	61.6	71.0
52 Jones	9	97.1	43	92.3	18.7	53.0	60.4	78.7
53 Lee	41	84.1	164	69.7	61.6	55.1	70.0	63.4
54 Lenoir	43	73.4	213	72.3	56.6	64.2	63.4	63.7
55 Lincoln	38	64.3	173	60.9	39.4	48.9	58.4	62.0
56 McDowell	34	84.8	141	73.5	37.9	55.8	68.4	62.5
57 Macon	18	63.9	127	94.3	41.7	41.7	44.8	56.0
58 Madison	9	47.9	56	61.7	43.9	45.3	54.9	47.5
59 Martin	18	70.2	91	70.6	49.0	55.1	79.0	61.7
60 Mecklenburg	272	43.6	1,322	44.6	51.1	59.1	62.2	57.2
61 Mitchell	12	82.1	67	91.4	44.7	49.0	56.1	64.6
62 Montgomery	20	80.9	84	69.4	43.9	44.9	64.2	67.8
63 Moore	63	89.0	319	93.8	52.6	60.2	47.8	62.1
64 Nash	56	63.6	258	60.3	45.9	52.9	56.1	60.3
65 New Hanover	86	58.0	465	65.2	58.8	67.5	73.0	62.7
66 Northampton	13	62.6	84	81.0	54.0	45.3	57.0	62.0
67 Onslow	69	46.3	299	40.3	54.1	63.7	73.2	85.8
68 Orange	50	45.8	217	40.7	47.1	50.6	56.7	56.8
69 Pamlico	12	99.2	47	78.7	68.3	64.7	81.3	57.6
70 Pasquotank	20	57.5	104	61.3	47.5	72.4	68.0	58.2
71 Pender	22	57.7	119	66.3	52.2	55.7	54.8	57.4
72 Perquimans	13	118.8	56	104.1	69.6	42.9	66.8	74.8
73 Person	19	57.1	123	75.8	40.2	50.1	68.2	67.6
74 Pitt	50	39.5	309	51.2	56.4	56.5	63.9	64.3
75 Polk	12	72.0	60	74.6	42.4	43.7	52.8	45.3
76 Randolph	75	60.4	367	61.9	42.2	49.4	56.2	61.0
77 Richmond	29	63.7	145	63.8	48.4	49.4	58.0	58.4
78 Robeson	75	65.5	348	62.1	41.7	56.3	62.2	70.9
79 Rockingham	83	92.6	361	81.3	44.8	52.1	65.7	70.7
80 Rowan	90	72.2	427	70.7	40.6	48.9	56.5	61.6
81 Rutherford	54	89.9	234	78.9	37.0	47.4	53.6	66.0
82 Sampson	34	63.8	183	71.0	47.7	52.1	61.3	62.4
83 Scotland	25	71.0	101	57.9	43.9	43.9	62.2	62.8
84 Stanly	34	61.1	176	64.5	37.3	48.3	55.8	56.2
85 Stokes	40	92.6	143	68.3	53.7	56.0	69.7	67.5
86 Surry	67	98.6	270	81.8	50.6	55.6	58.3	67.7
87 Swain	9	74.0	41	69.4	38.0	48.8	62.9	56.8
88 Transylvania	25	88.3	125	90.6	51.1	51.2	47.7	61.7
89 Tyrrell	3	77.0	14	74.2	56.4	81.8	45.0	58.5
90 Union	53	48.1	240	47.0	44.7	57.4	57.7	56.7
91 Vance	36	86.4	162	79.7	56.3	61.7	72.0	78.5
92 Wake	214	37.2	988	36.8	49.9	55.8	53.6	54.3
93 Warren	16	84.6	67	73.4	60.6	65.0	56.5	52.6
94 Washington	14	106.8	66	97.7	63.9	62.3	49.3	85.2
95 Watauga	22	53.7	90	44.6	45.7	40.2	45.7	49.4
96 Wayne	82	72.4	334	59.8	41.1	61.9	69.4	66.5
97 Wilkes	47	74.2	202	64.6	36.1	46.1	46.8	56.7
98 Wilson	52	74.9	232	67.9	66.0	55.7	69.9	65.4
99 Yadkin	37	103.8	114	66.2	36.2	40.2	54.0	54.8
100 Yancey	10	60.3	49	60.3	40.0	58.9	32.4	43.5

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Cancer - Trachea, Bronchus and Lung

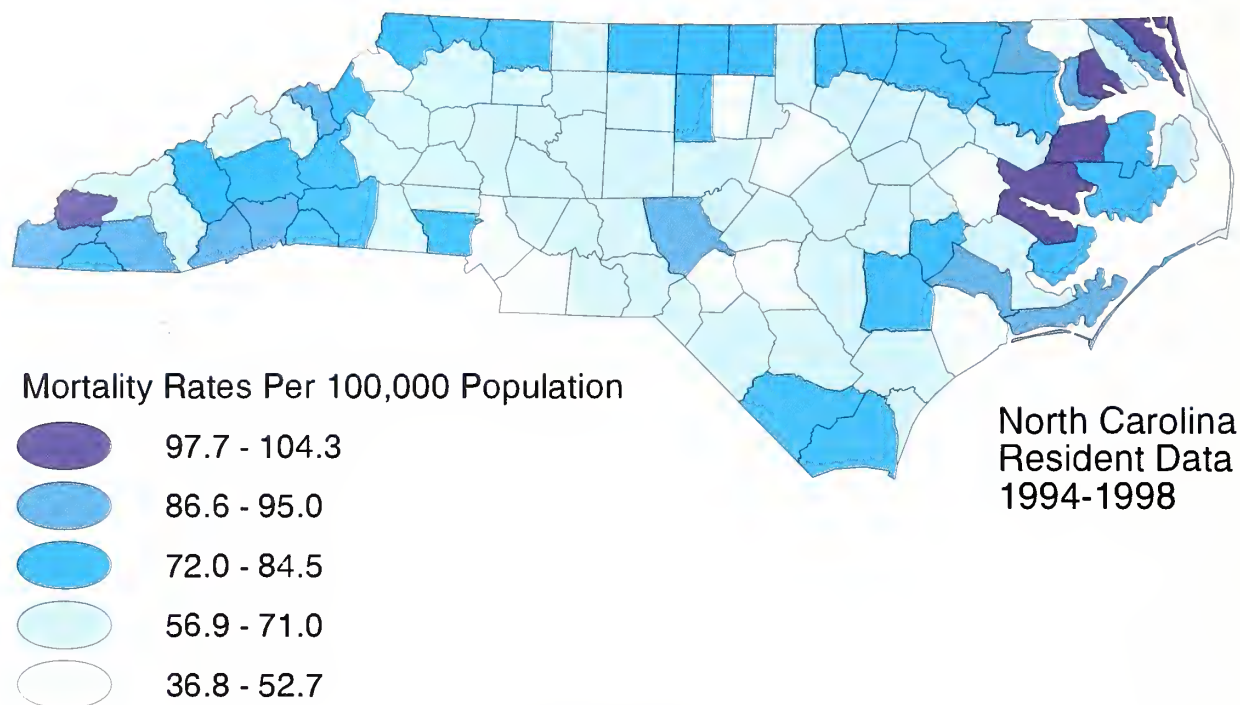


Figure 6.C

Cancer - Trachea, Bronchus and Lung

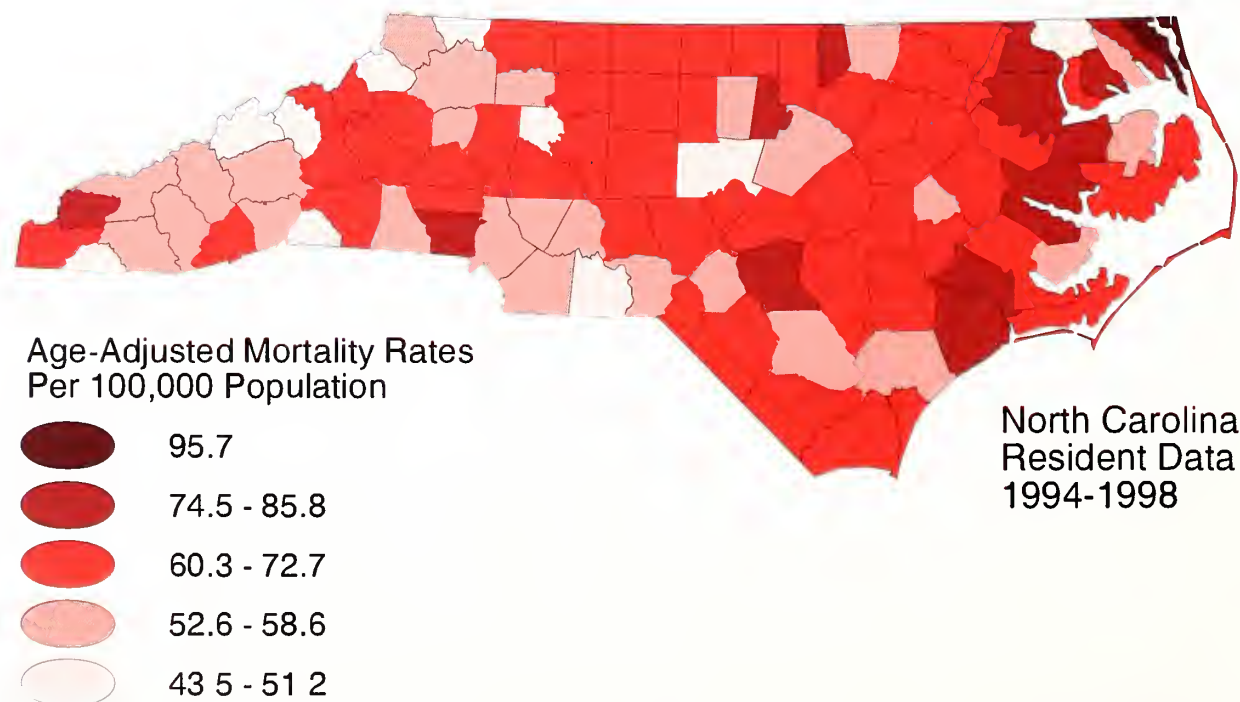


Figure 6.D

Cancer of the Female Breast

Introduction

Breast cancer is the most frequently occurring cancer in women, both in North Carolina and the United States. The American Cancer Society estimates 175,000 new invasive cases of breast cancer are expected to occur among women in the United States during 1999 with about 1,300 newly diagnosed cases of breast cancer expected in men for 1999.¹ The North Carolina Central Cancer Registry estimates a projected 5,660 new breast cancer cases among North Carolina women in 1999.

Differentials and Trends

According to the most recent SEER (U.S.) data (1973-1996), female breast cancer incidence rates among white females increased until 1987 and declined moderately thereafter. Rates for African-American women peaked in 1992 for women over age fifty and in 1991 for women under age fifty. Incidence rates for African-American women under age 50 have declined moderately since 1991, whereas rates for African-American women over 50 have remained relatively constant since 1992.¹

After increasing about 4 percent per year in the 1980s, breast cancer incidence rates in women leveled off in the 1990s. The incidence rate of female breast cancer was highest among white women and lowest among American-Indian women, yet African-American women were more likely to die of breast cancer than women of any other racial/ethnic group.

In 1998 there were 1,163 deaths from female breast cancer among North Carolinians. The number of deaths has remained stable since 1990. With breast cancer as the second major cause of cancer death among women, this accounted for 7.6 percent of the state's cancer deaths and 1.7 percent of all deaths. Based on North Carolina data from 1990-1997, about 65 percent of breast cancers were diagnosed at the local or in-situ stages.

United States mortality rates have declined over the past 10 years with noticeable decreases in younger women (both white and African-American), and this is attributed to earlier detection and improved treatment. An estimated 43,400 deaths are predicted nationally for 1999, but that estimate could prove to be too high if this trend continues. These data also indicate that while female breast cancer mortality rates for whites over age fifty declined over the past ten years, rates for African-American women over age 50 increased until 1990 and have been relatively stable since then. In North Carolina, the overall 5-year age-adjusted female breast cancer mortality rate (1994 -1998) declined by 9.2 percent from the 1984-1988 rate (from 31.5 per 100,000 females to 28.6).

The five-year survival rate for localized (early stage) breast cancer increased from 72 percent in the 1940's to 97 percent today. If the breast cancer was in situ (not invasive), the survival rate approaches 100 percent. If the cancer has spread regionally, the survival rate is 77 percent; and for women with distant metastases, the survival rate is 20 percent. Survival after a diagnosis of breast cancer declines beyond five years. Seventy percent of women diagnosed with breast cancer survive ten years, and 56 percent survive 15 years.²

Risk Factors

Approximately one in eight women will develop breast cancer sometime during their life. Breast cancer risk increases with age, with rates greatest for women over the age of 50. Several risk factors for breast cancer have been consistently identified. A personal or family history of breast cancer is the most established factor and familial risk is now being associated with specific gene mutations or oncogenes. Histories of ovarian or endometrial cancer are also known to be associated with increased cancer risk. Increased risk for breast cancer has been associated with first full-term pregnancy after age 30, and also with early menarche and late menopause. Obesity, heavy alcohol use, high-fat diets, and estrogen replacement therapy have been suggested as possible risk factors for breast cancer. A majority of women have one or more of these risk factors for breast cancer.³

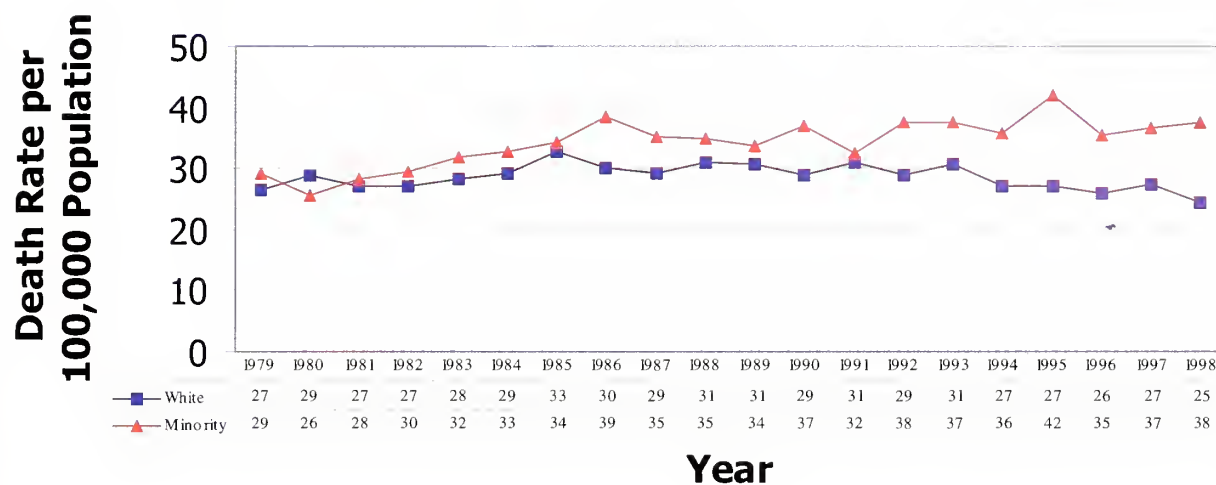
Geographic Patterns

The 1994-1998 period demonstrated a considerable variability among the counties (Figures 7.B and 7.C). The age-adjusted rates show generally higher rates in the eastern counties, likely due to higher concentration of African Americans in these counties. Users should consult these maps to ascertain a county's relative level of unadjusted and age-adjusted mortality from female breast cancer.

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Female Breast Cancer: North Carolina Resident Age-Adjusted* Death Rates by Race 1979-1998



*U.S. 2000 standard population

Figure 7.A

TABLE 7
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Cancer – Female Breast

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	1,163	29.9	5,825	30.9	27.9	31.5	31.2	28.6
1 Alamance	19	29.8	112	36.3	33.0	27.0	28.8	29.2
2 Alexander	1	6.3	12	15.6	28.3	23.0	25.2	14.6
3 Alleghany	5	98.3	14	55.9	14.9	24.7	15.6	38.9
4 Anson	7	54.9	35	55.1	20.4	35.7	26.1	49.3
5 Ashe	4	32.8	16	26.6	31.4	27.2	19.8	19.9
6 Avery	4	52.4	10	26.3	39.5	25.4	20.2	19.2
7 Beaufort	10	43.6	39	34.1	27.3	28.8	37.1	27.2
8 Bertie	6	55.0	25	45.2	35.8	35.0	28.9	38.5
9 Bladen	7	42.4	30	37.3	13.9	23.7	45.3	32.6
10 Brunswick	11	31.9	52	32.3	33.1	26.5	29.0	26.0
11 Buncombe	38	37.6	214	43.0	29.0	29.2	34.8	33.3
12 Burke	11	25.8	62	29.7	20.6	31.5	25.4	25.5
13 Cabarrus	17	27.5	78	26.7	30.0	39.6	28.6	23.6
14 Caldwell	8	20.9	44	23.3	17.4	27.3	24.5	20.7
15 Camden	2	64.3	7	45.2	27.0	46.0	14.4	39.1
16 Carteret	10	33.3	55	37.3	32.9	32.2	40.5	30.9
17 Caswell	5	43.5	23	41.3	34.1	19.4	28.2	32.8
18 Catawba	22	32.7	95	29.0	27	32.0	34.5	26.0
19 Chatham	14	59.0	41	36.0	21.2	23.7	39.9	28.2
20 Cherokee	5	42.4	23	40.2	39	26.4	25.0	29.6
21 Chowan	6	77.6	17	44.7	46.9	50.8	30.7	30.8
22 Clay	2	46.7	8	39.1	31.9	43.6	35.4	27.2
23 Cleveland	19	39.9	95	40.7	23.8	33.6	17.9	34.3
24 Columbus	8	28.8	43	31.3	22.3	25.6	26.0	26.4
25 Craven	13	29.0	62	28.3	28.9	32.3	29.9	28.2
26 Cumberland	27	18.8	169	23.5	29.5	32.5	27.8	29.7
27 Currituck	1	11.7	9	22.3	41.5	30.9	43.7	20.4
28 Dare	3	21.2	25	37.5	15.2	21.5	25.2	35.8
29 Davidson	15	20.9	102	29.0	26.3	32.4	23.1	26.4
30 Davie	10	61.1	26	33.4	25.4	42.6	18.6	27.2
31 Duplin	8	35.0	48	42.8	28.9	26.3	35.1	37.2
32 Durham	38	36.0	176	34.2	33.0	37.1	32.9	35.9
33 Edgecombe	10	33.3	48	31.4	25.0	37.6	38.4	28.7
34 Forsyth	51	33.4	263	35.2	29.3	31.8	30.2	31.8
35 Franklin	8	34.7	40	36.2	31.5	21.1	31.7	32.9
36 Gaston	29	31.0	149	32.1	22.8	25.6	31.4	29.4
37 Gates	3	59.2	14	56.0	31.0	35.8	35.9	49.4
38 Graham	1	26.5	8	42.4	11.9	9.1	9.7	32.0
39 Granville	12	53.5	44	41.3	37.7	16.5	35.4	37.6
40 Greene	1	11.1	12	28.2	17.9	22.7	30.3	23.4
41 Guilford	64	31.3	317	31.9	30.7	33.0	31.9	29.6
42 Halifax	12	41.0	66	44.3	27.7	27.5	37.6	40.9
43 Harnett	17	39.5	70	34.3	21.4	36.7	28.6	33.9
44 Haywood	9	33.2	47	35.4	28.1	29.8	34.4	24.0
45 Henderson	11	26.0	62	30.5	30.5	35.8	32.4	19.3
46 Hertford	4	34.1	22	36.7	17.4	27.5	35.9	34.5
47 Hoke	4	26.9	15	21.4	16.6	23.0	33.3	23.9
48 Hyde	0	0.0	3	21.9	35.0	18.7	52.6	21.6
49 Iredell	15	25.7	78	28.4	26.7	34.9	28.6	24.3
50 Jackson	7	45.5	21	27.8	28.9	31.7	24.5	25.2

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 7 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Cancer – Female Breast

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	20	36.2	78	30.5	23.0	25.1	26.9	27.7
52 Jones	0	0.0	7	28.3	34.7	36.2	13.0	28.3
53 Lee	5	19.9	27	22.2	26.5	33.3	28.2	20.1
54 Lenoir	13	41.4	62	39.3	30.6	30.3	39.0	32.1
55 Lincoln	4	13.4	39	27.1	25.5	26.4	35.4	25.0
56 McDowell	3	14.7	36	36.7	32.0	13.3	22.7	29.2
57 Macon	5	34.0	27	38.4	30.9	28.5	31.9	23.1
58 Madison	4	42.2	19	41.5	22.3	26.3	34.5	30.5
59 Martin	2	14.7	20	29.3	45.5	29.6	31.4	22.2
60 Mecklenburg	80	24.7	409	26.6	31.6	36.0	34.7	29.4
61 Mitchell	5	65.4	13	34.0	39.7	22.5	33.4	25.4
62 Montgomery	4	33.4	20	33.9	26.7	40.8	30.6	30.9
63 Moore	19	51.1	81	45.4	35.6	39.7	34.5	29.2
64 Nash	16	34.6	70	31.2	26.2	32.3	36.8	28.9
65 New Hanover	20	25.6	105	28.0	24.5	31.8	36.4	25.7
66 Northampton	2	18.5	25	46.3	19.6	45.3	37.6	33.5
67 Onslow	12	19.2	54	17.4	26.0	28.6	28.9	26.6
68 Orange	19	33.1	73	26.0	25.1	30.1	31.2	31.5
69 Pamlico	1	15.9	11	35.3	24.3	14.1	33.4	24.7
70 Pasquotank	6	32.3	31	34.2	32.6	28.4	28.4	32.2
71 Pender	4	20.3	21	22.6	28.9	37.4	39.6	20.2
72 Perquimans	3	52.9	9	32.2	26.4	27.0	33.5	23.1
73 Person	6	34.6	33	39.0	19.8	31.2	37.6	33.3
74 Pitt	18	27.1	85	26.8	35.1	35.9	32.3	30.2
75 Polk	5	56.1	22	51.1	24.1	25.8	27.6	31.0
76 Randolph	17	26.9	86	28.4	21.9	31.3	35.4	25.6
77 Richmond	8	33.7	53	44.6	23.6	30.3	35.4	37.4
78 Robeson	12	19.9	71	24.0	25.8	24.0	30.1	25.3
79 Rockingham	19	40.4	85	36.5	26.9	33.0	33.8	29.9
80 Rowan	21	32.9	109	35.2	24.0	29.8	29.9	28.6
81 Rutherford	10	32.3	48	31.3	25.3	30.3	22.5	23.9
82 Sampson	8	28.5	61	45.0	25.8	31.7	27.9	37.6
83 Scotland	3	15.8	26	27.7	32.1	43.6	25.9	26.7
84 Stanly	10	34.9	49	34.8	25.2	31.0	30.3	29.6
85 Stokes	4	18.2	23	21.6	22.7	28.6	22.9	19.7
86 Surry	14	39.6	48	27.9	24.2	27.7	32.3	20.9
87 Swain	3	50.0	11	37.7	36.3	16.5	29.4	28.7
88 Transylvania	6	41.2	30	42.3	25.9	43.2	29.2	27.6
89 Tyrrell	1	49.3	6	61.1	34.6	47.7	38.9	43.0
90 Union	11	19.6	60	23.1	24.0	32.4	30.7	24.9
91 Vance	7	31.6	39	36.2	26.7	42.3	27.1	33.4
92 Wake	61	20.7	310	22.6	32.3	33.1	32.1	27.4
93 Warren	3	30.5	24	50.6	28.8	35.8	26.9	38.5
94 Washington	6	86.4	15	42.0	21.1	35.7	39.8	36.0
95 Watauga	5	23.8	18	17.4	17.6	49.7	22.8	18.4
96 Wayne	16	28.6	79	28.5	28.5	35.4	35.7	28.1
97 Wilkes	8	24.8	44	27.6	23.8	16.9	23.6	23.5
98 Wilson	18	48.5	68	37.2	26.8	33.6	33.2	33.7
99 Yadkin	1	5.5	25	28.2	20.4	33.5	39.6	21.8
100 Yancey	1	11.7	14	33.4	34.2	33.3	26.3	22.9

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Cancer - Female Breast

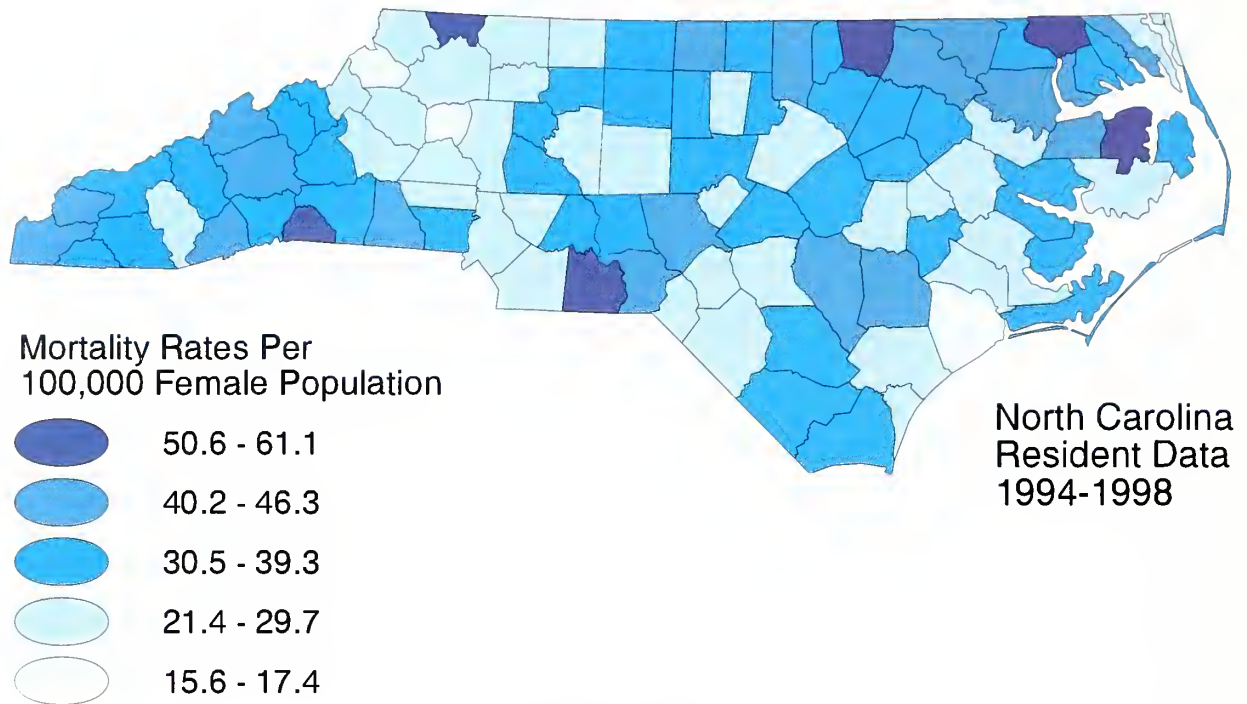


Figure 7.B

Cancer - Female Breast

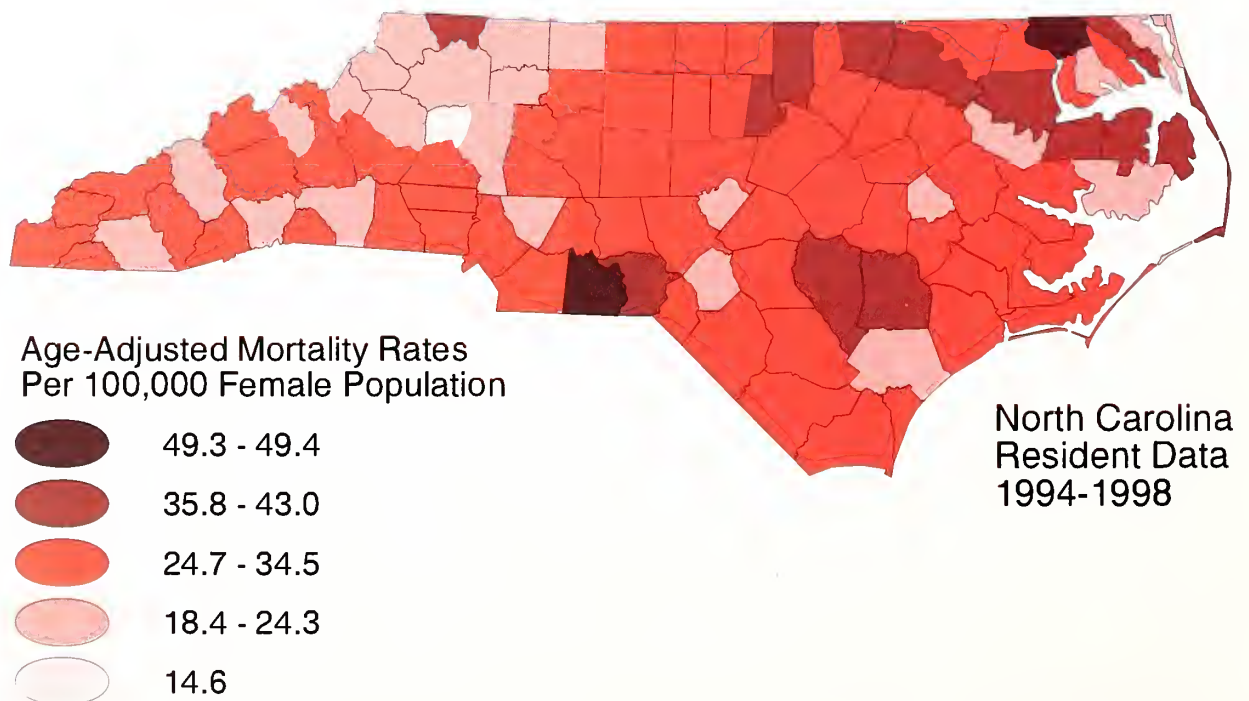


Figure 7.C

Cancer of the Prostate

Introduction

Prostate cancer is a major cause of morbidity and mortality among males in the United States, with nearly one in six men developing the disease during his lifetime. In North Carolina during 1999 alone, an estimated 5,100 new cases were diagnosed.¹ In 1998, a total of 983 North Carolina men died of prostate cancer. This accounted for 15 percent of the state's male cancer deaths (6.5 percent of all cancer deaths) and three percent of all male deaths (1.5 percent of all deaths). The prostate cancer mortality rate in North Carolina in 1998 was 26.9 deaths per 100,000 resident men.

Differentials and Trends

The five-year age-adjusted mortality rate for 1994-98 represented an 8 percent decline from the preceding five-year period (1989-93). With the advent of better diagnostic tools in the early 1990's, the number of detected cases of prostate cancer has increased, while the death rate has declined.²

The death rate for this disease changes dramatically with age, increasing over sixty-fold between ages 50 and 75. For ages 80-84, the rate is 464 deaths per 100,000 male population and peaks at over 800 at ages 85 and older.³

Prostate cancer is much higher in minorities than in whites. In fact, the age-adjusted mortality rate for minorities across the state is about 2.5 times that of whites; this pattern mirrors national data.³

Risk Factors

The incidence of prostate cancer increases with age (especially after age 60). Persons with a family history of prostate cancer have a two-and-a-half times higher risk of developing prostate cancer. Unfortunately little else is known about the risk factors for prostate cancer. However, fat intake is specifically being studied by North Carolina researchers; differences in the metabolism of fatty acids between blacks and whites is the research focus.⁴

As is the case with many types of cancer, failure to have timely and appropriate screening also puts men at increased risk of prostate cancer mortality. The American Cancer Society recommends that both the Digital Rectal Exam (DRE) and Prostate-Specific Antigen (PSA) blood test be performed annually.⁴ However, other agencies (e.g. National Cancer Institute) do not support the use of PSA screening as of yet.⁵ With these controversies in standards of care, it is more difficult for patients and physicians to determine proper screening protocols.

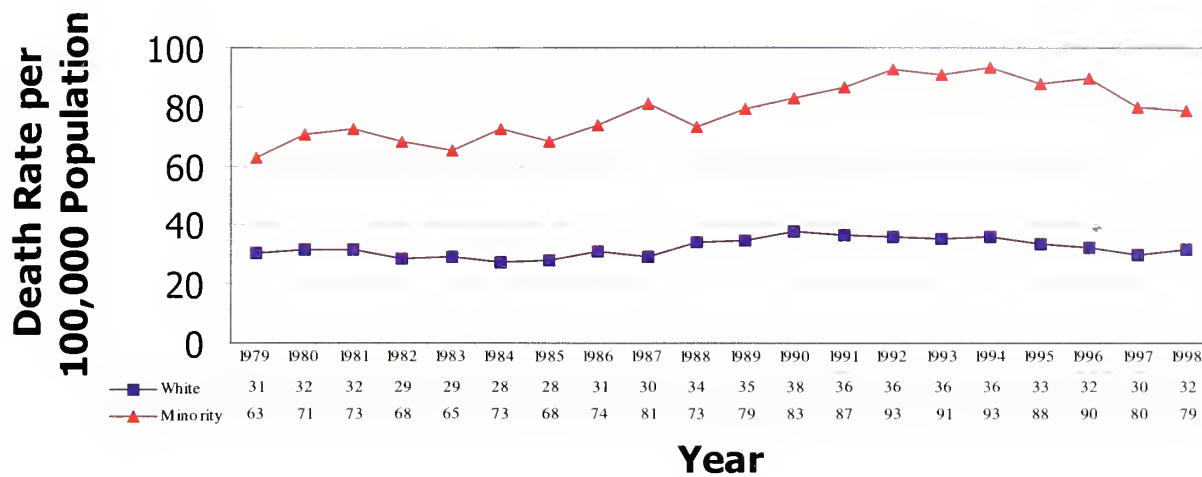
Geographic Patterns

As shown in Figure 8.C, one can see that the eastern portion of the state has higher age-adjusted mortality rates. However, this geographic pattern is probably due primarily to higher percentages of minority persons in the eastern counties, and minority males are significantly more likely to die from prostate cancer than white males.

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Prostate Cancer: North Carolina Resident Age-Adjusted* Death Rates by Race 1979-1998



*U.S. 2000 standard population

Figure 8.A

TABLE 8
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Cancer – Prostate

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	983	26.9	4,982	28.1	37.6	38.2	44.9	41.0
1 Alamance	15	25.9	92	32.9	30.1	37.5	45.6	39.3
2 Alexander	2	12.6	20	26.2	35.3	34.1	51.1	43.4
3 Alleghany	2	42.0	17	72.8	17.5	41.9	3.0	61.4
4 Anson	7	62.1	32	57.1	40.5	34.0	34.3	65.7
5 Ashe	6	52.1	22	38.9	30.7	46.3	46.2	31.0
6 Avery	2	26.0	11	28.8	50.0	22.5	9.5	30.1
7 Beaufort	6	29.2	40	39.1	33.5	43.0	54.8	50.4
8 Bertie	0	0.0	24	51.5	47.3	43.5	79.3	57.7
9 Bladen	5	35.0	25	35.7	34.0	40.3	63.3	40.2
10 Brunswick	9	27.4	47	30.6	23.1	37.1	43.5	33.8
11 Buncombe	25	27.1	158	34.9	36.0	32.7	43.1	35.9
12 Burke	7	16.9	31	15.3	36.2	22.4	40.4	22.0
13 Cabarrus	9	15.3	56	20.3	17.3	13.4	36.3	33.4
14 Caldwell	9	24.2	43	23.6	27.5	39.3	43.8	34.9
15 Camden	1	30.6	3	18.7	121.3	15.7	55.1	28.3
16 Carteret	10	34.3	41	28.6	34.2	36.0	40.8	35.5
17 Caswell	6	55.2	36	68.2	44.1	44.4	33.4	74.3
18 Catawba	19	29.6	93	29.9	33.5	23.3	38.7	46.2
19 Chatham	11	49.5	34	31.9	30.8	42.0	51.5	33.6
20 Cherokee	6	54.6	24	45.1	39.7	16.5	30.2	32.8
21 Chowan	5	75.1	14	42.8	53.0	89.4	45.9	43.1
22 Clay	3	75.8	17	89.6	5.8	11.0	37.5	71.7
23 Cleveland	22	49.8	69	31.9	32.3	37.9	49.4	41.8
24 Columbus	6	24.6	49	40.5	51.6	47.3	47.1	54.2
25 Craven	18	40.7	62	28.8	53.1	24.6	48.2	46.7
26 Cumberland	24	16.1	138	18.4	41.6	41.8	48.6	56.1
27 Currituck	4	46.3	17	41.5	41.5	62.9	41.8	70.2
28 Dare	1	7.1	16	24.3	10.9	27.4	36.9	43.1
29 Davidson	16	23.0	74	21.7	26.5	24.6	39.5	30.5
30 Davie	6	38.0	19	25.3	32.3	33.9	51.0	32.4
31 Duplin	14	65.5	47	45.0	45.4	54.6	59.9	58.3
32 Durham	24	25.2	115	24.9	45.9	42.8	58.3	44.6
33 Edgecombe	8	32.4	45	35.6	56.8	63.5	60.6	53.7
34 Forsyth	41	29.9	194	29.0	38.1	42.7	41.0	43.0
35 Franklin	15	70.2	42	41.1	27.7	36.1	30.8	58.6
36 Gaston	8	9.1	97	22.4	33.6	33.5	28.7	35.8
37 Gates	1	20.3	12	49.4	23.0	47.0	20.8	55.1
38 Graham	2	54.2	11	59.4	36.1	54.5	31.5	54.8
39 Granville	6	27.2	32	30.6	47.0	30.3	53.4	43.1
40 Greene	2	21.4	11	25.1	58.3	21.6	34.3	39.3
41 Guilford	58	31.6	268	30.0	45.1	39.8	42.6	43.7
42 Halifax	9	34.4	58	43.5	45.4	46.1	59.9	53.0
43 Harnett	7	17.3	56	29.2	51.8	51.7	50.4	45.2
44 Haywood	12	49.0	38	31.7	24.7	23.2	24.5	26.6
45 Henderson	19	49.2	82	44.2	33.1	30.2	36.7	32.0
46 Hertford	5	50.9	21	41.5	62.5	66.0	66.0	47.4
47 Hoke	2	13.2	22	31.0	29.0	38.6	75.8	69.5
48 Hyde	0	0.0	3	23.1	35.7	56.9	66.6	29.8
49 Iredell	12	21.8	61	23.6	31.8	38.1	35.5	31.3
50 Jackson	3	21.2	23	33.1	31.1	31.7	45.0	35.5

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 8 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Cancer – Prostate

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	11	21.0	55	22.8	33.6	45.2	50.6	32.5
52 Jones	2	46.0	10	45.8	51.3	50.4	32.6	52.6
53 Lee	6	25.4	29	25.5	38.3	33.0	47.6	37.8
54 Lenoir	6	22.1	46	33.6	36.2	34.0	51.6	48.1
55 Lincoln	7	24.0	34	24.2	30.2	25.6	35.6	39.3
56 McDowell	7	35.6	35	37.3	21.8	24.7	36.6	42.0
57 Macon	7	52.1	25	38.9	42.6	55.2	35.8	25.7
58 Madison	3	32.2	15	33.4	38.8	50.0	21.3	30.1
59 Martin	3	24.9	28	46.2	33.8	45.3	57.7	55.4
60 Mecklenburg	66	21.9	299	20.9	45.5	42.3	50.8	40.5
61 Mitchell	3	42.9	7	20.0	32.3	26.6	21.7	18.4
62 Montgomery	4	31.4	19	30.6	33.1	25.0	35.0	41.4
63 Moore	12	35.7	66	40.8	43.6	32.5	48.2	32.2
64 Nash	14	33.4	62	30.5	32.6	41.4	50.8	45.5
65 New Hanover	20	28.5	99	29.3	38.8	44.6	44.7	40.1
66 Northampton	6	60.3	37	74.3	59.9	32.3	49.0	73.8
67 Onslow	15	17.4	49	11.4	45.6	46.3	59.7	47.2
68 Orange	11	21.2	55	21.8	31.5	38.6	52.6	43.4
69 Pamlico	3	51.8	20	70.0	31.3	28.0	45.7	66.2
70 Pasquotank	5	30.9	30	37.9	57.1	55.1	43.6	46.0
71 Pender	14	76.0	39	44.9	68.6	64.0	66.6	59.2
72 Perquimans	6	113.7	17	65.6	66.5	35.2	40.5	57.5
73 Person	4	25.1	19	24.5	35.4	44.2	39.2	29.6
74 Pitt	16	26.6	77	26.9	35.6	48.0	66.4	50.4
75 Polk	3	38.7	18	48.1	24.3	38.8	32.7	30.1
76 Randolph	11	18.1	79	27.2	23.7	29.6	36.2	39.0
77 Richmond	6	27.6	41	37.7	37.3	48.7	45.4	46.6
78 Robeson	14	25.9	90	34.1	62.5	41.7	57.4	60.0
79 Rockingham	13	30.5	74	35.1	36.1	38.0	48.1	41.7
80 Rowan	22	36.1	108	36.7	29.0	39.0	47.4	40.6
81 Rutherford	8	27.5	33	23.0	28.1	30.9	37.2	26.9
82 Sampson	7	27.7	45	36.8	33.1	35.3	40.8	43.9
83 Scotland	1	6.2	34	42.1	29.1	71.3	46.2	65.7
84 Stanly	6	22.3	33	25.0	31.3	40.0	32.1	29.8
85 Stokes	6	28.2	27	26.2	42.7	33.2	42.6	36.6
86 Surry	7	21.5	39	24.7	35.2	23.3	43.6	30.0
87 Swain	3	48.6	15	50.2	37.0	34.2	23.4	57.4
88 Transylvania	10	72.7	36	53.7	16.2	32.9	37.5	42.7
89 Tyrrell	1	53.6	7	77.5	54.5	40.0	25.2	68.8
90 Union	6	11.1	56	22.3	29.9	39.8	64.5	44.6
91 Vance	12	61.4	42	44.0	48.3	66.5	54.8	64.4
92 Wake	46	16.4	223	17.0	41.4	37.4	48.3	42.2
93 Warren	7	77.0	28	64.0	58.6	58.0	82.0	62.8
94 Washington	1	16.2	8	25.1	51.2	59.4	53.7	30.5
95 Watauga	6	30.1	23	23.4	27.5	18.6	36.6	34.4
96 Wayne	12	20.9	73	25.9	46.2	52.3	56.7	45.7
97 Wilkes	5	16.1	37	24.2	27.7	27.0	30.8	30.1
98 Wilson	8	24.8	48	30.2	41.0	34.2	56.1	43.1
99 Yadkin	0	0.0	19	22.7	36.1	53.7	35.9	27.9
100 Yancey	1	12.5	12	30.5	26.8	45.1	28.0	27.3

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Cancer - Prostate

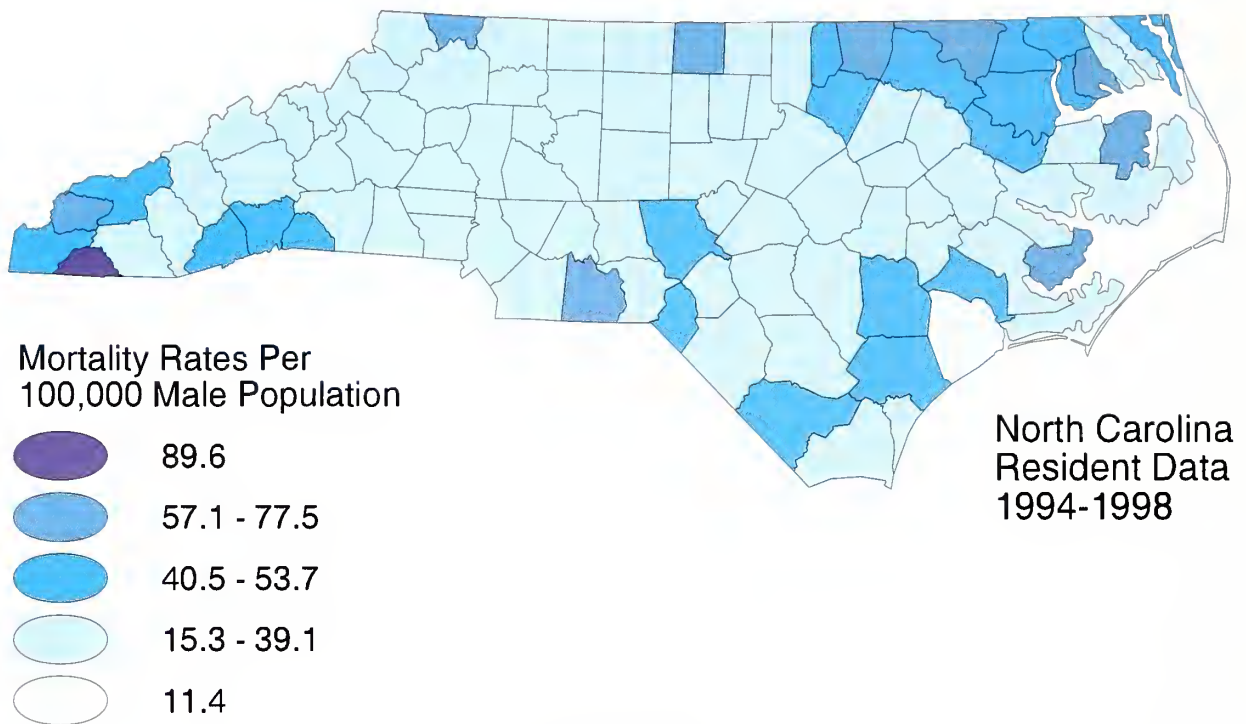


Figure 8.B

Cancer - Prostate

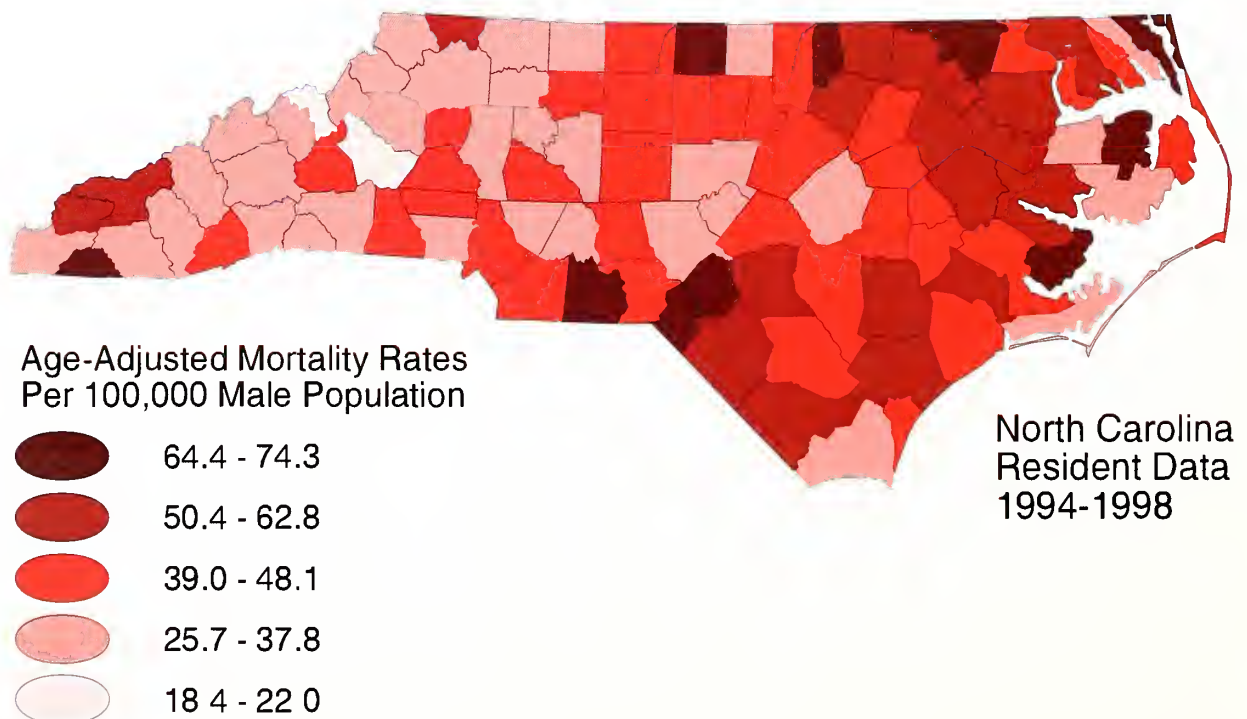


Figure 8.C

Acquired Immune Deficiency Syndrome

Introduction

In North Carolina, acquired immune deficiency syndrome (AIDS) accounted for 432 deaths in 1998, resulting in a rate of 5.7 AIDS deaths per 100,000 population. Since 1996, the number of North Carolina residents who have died from AIDS has dropped significantly to the point where AIDS is no longer ranked among the ten leading causes of death in the state. AIDS deaths have also dropped in ranking for each age and race group.

Differentials and Trends

Consistent with national trends^{1,2} the North Carolina AIDS death rate began a period of decline in 1996, dropping 19.9 percent from 1995. The rate decreased 42.5 percent from 1996 to 1997 and decreased 12.3 percent from 1997 to 1998. Although there has been a substantial decrease in the rate for the three-year period, the rate of decrease slowed from 1997 to 1998. This slowing of the rate of decline was also consistent with the national trend.²

In the United States, the demographics of HIV infection and AIDS have changed since the first cases were reported in 1981. Although homosexual men represented the largest demographic group in the early years of the epidemic, new cases of HIV infection are primarily the result of injection-drug use and heterosexual contact. As a result, minorities are disproportionately represented and the number of HIV cases among women is increasing.³ North Carolina death rates reflect this pattern.

North Carolina AIDS data for 1998 showed that 78.7 percent of AIDS decedents were of a racial minority, 71.5 percent were male, and 69.0 percent were between the ages of 25 and 44. These disparities between demographic groups were also reflected by race and sex-specific age-adjusted death rates. In 1998, the minority rate was 19.7 and the white rate was 1.6. The age-adjusted death rate for males was 8.3 and the rate for females was 3.2. Comparing age-adjusted rates across race and sex groups, all age-adjusted rates decreased from 1997 to 1998 with the exception of the rate for females. The rate for females increased from 3.1 to 3.2.

Closer examination of AIDS deaths within specific race-sex groups revealed that AIDS disproportionately affected minority women and men. The 1994-1998 age-adjusted death rate was 0.7 for white females and 14.3 for minority females. For white males it was 7.3 and for minority males it was 50.3.

Unlike other cause-specific deaths reported in this issue, a twenty-year description of mortality trends for AIDS is not possible. AIDS deaths have only been recorded since 1987. Prior to 1987, AIDS deaths were coded as "deficiency of cell-mediated immunity," which could also include conditions other than AIDS. Beginning in 1987, AIDS deaths were recorded under ICD-9 codes 042-044. Five-year age-adjusted death rates show an increase from 7.9 deaths per 100,000 population in 1989-1993 to 10.1 deaths per 100,000 population in 1994-1998, representing a 27.8 percent increase across the two five-year periods. Although comparisons between the two five-year periods reflect a large increase in the rate of AIDS deaths, single-year death rates reflect a sharp decline from 1996 through 1998.

Risk Factors

The sharp decreases in the death rates between 1996 and 1998 in the United States have been attributed to a number of factors. These factors include improved prophylaxis against opportunistic infections, improved treatment, a growing experience among health professionals in caring for HIV-infected patients, improved access to health care, prevention efforts, and the fact that a substantial proportion of persons with high-risk behavior are already infected.³ Moreover, "...the most influential factor has clearly been the increased use of anti-HIV drugs, generally administered in combinations of three or more agents and usually including a protease inhibitor".³ A slower decline in the rate from 1996 to 1998 may indicate that much of the benefit of the new drug therapies has been realized.⁴

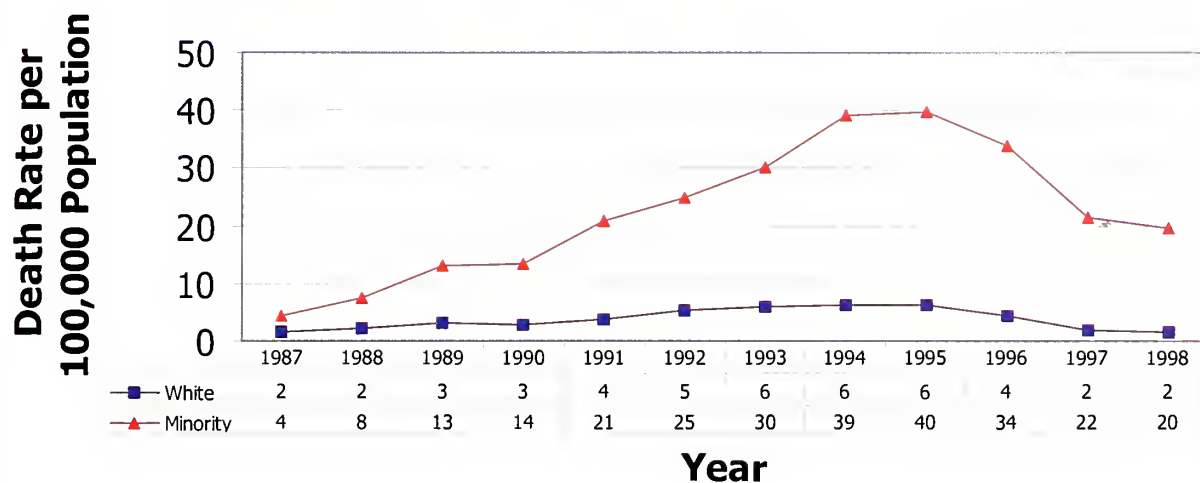
Geographic Patterns

The geographic distribution of AIDS mortality is presented in two maps. Figure 9.C shows the distribution of unadjusted death rates for 1994-1998 and Figure 9.D shows the distribution of age-adjusted AIDS rates for 1994-1998. In general, both maps show the same spatial distribution. Eastern North Carolina is characterized by higher AIDS death rates with high rates also in Mecklenburg County. A larger minority population in the eastern part of the state may primarily explain these geographic differences in rates.

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3. Fauci AS. The AIDS epidemic: considerations for the 21st century. *New England Journal of Medicine* 1999; 341:1046-1050.
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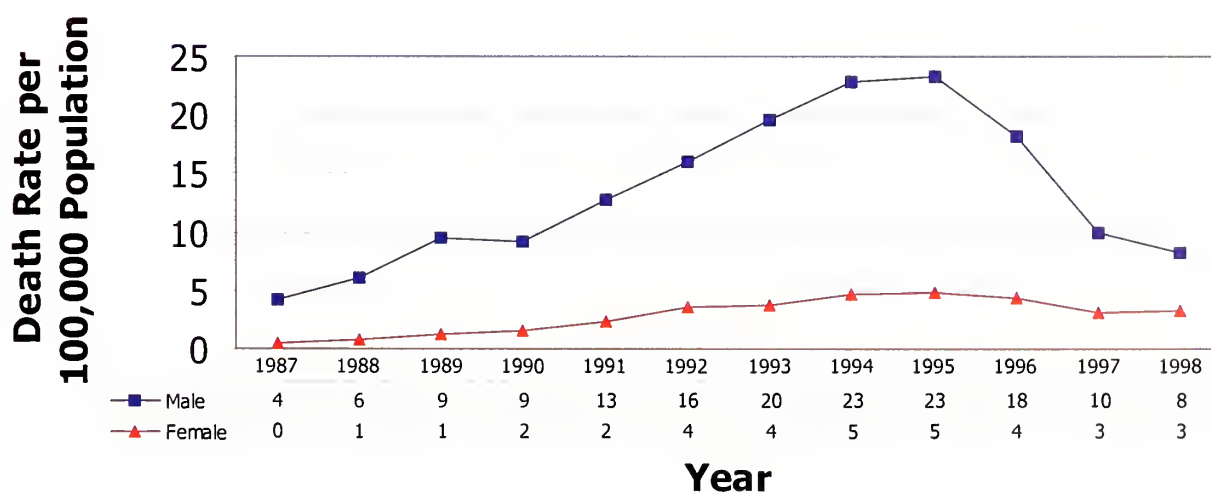
**Acquired Immune Deficiency Syndrome (AIDS):
North Carolina Resident
Age-Adjusted* Death Rates by Race 1979-1998**



*U.S. 2000 standard population

Figure 9.A

**Acquired Immune Deficiency Syndrome (AIDS):
North Carolina Resident
Age-Adjusted* Death Rates by Sex 1979-1998**



*U.S. 2000 standard population

Figure 9.B

TABLE 9
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Acquired Immune Deficiency Syndrome (AIDS)

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	432	5.7	3,724	10.2	n/a	n/a	7.9	10.1
1 Alamance	1	0.8	40	6.8	n/a	n/a	6.1	6.7
2 Alexander	0	0.0	4	2.6	n/a	n/a	2.6	2.8
3 Alleghany	0	0.0	1	2.1	n/a	n/a	2.3	2.0
4 Anson	4	16.7	14	11.7	n/a	n/a	9.5	12.2
5 Ashe	0	0.0	1	0.9	n/a	n/a	0.0	0.9
6 Avery	0	0.0	0	0.0	n/a	n/a	2.5	0.0
7 Beaufort	3	6.9	33	15.2	n/a	n/a	7.3	15.7
8 Bertie	2	10.0	10	9.8	n/a	n/a	4.1	10.2
9 Bladen	4	13.0	20	13.3	n/a	n/a	7.9	13.7
10 Brunswick	2	3.0	19	6.0	n/a	n/a	7.5	6.6
11 Buncombe	11	5.7	111	11.7	n/a	n/a	5.7	11.7
12 Burke	1	1.2	16	3.9	n/a	n/a	1.9	3.8
13 Cabarrus	2	1.7	28	4.9	n/a	n/a	6.1	4.7
14 Caldwell	0	0.0	8	2.2	n/a	n/a	2.2	2.1
15 Camden	0	0.0	2	6.3	n/a	n/a	3.0	6.3
16 Carteret	2	3.4	9	3.1	n/a	n/a	4.5	3.1
17 Caswell	0	0.0	4	3.7	n/a	n/a	6.2	3.7
18 Catawba	2	1.5	29	4.5	n/a	n/a	4.6	4.4
19 Chatham	2	4.4	14	6.4	n/a	n/a	2.7	6.0
20 Cherokee	0	0.0	4	3.6	n/a	n/a	4.2	3.5
21 Chowan	0	0.0	6	8.5	n/a	n/a	9.5	9.7
22 Clay	0	0.0	3	7.6	n/a	n/a	0.0	7.5
23 Cleveland	3	3.3	33	7.3	n/a	n/a	7.4	7.5
24 Columbus	5	9.6	26	10.1	n/a	n/a	11.2	10.6
25 Craven	5	5.6	38	8.7	n/a	n/a	6.4	9.3
26 Cumberland	17	5.8	149	10.1	n/a	n/a	8.2	10.4
27 Currituck	1	5.8	2	2.5	n/a	n/a	6.5	2.4
28 Dare	1	3.6	4	3.0	n/a	n/a	3.0	2.7
29 Davidson	2	1.4	31	4.5	n/a	n/a	4.8	4.3
30 Davie	0	0.0	2	1.3	n/a	n/a	4.0	1.3
31 Duplin	4	9.0	23	10.6	n/a	n/a	10.1	10.9
32 Durham	25	12.5	240	24.6	n/a	n/a	18.1	23.6
33 Edgecombe	8	14.6	47	16.8	n/a	n/a	7.7	17.3
34 Forsyth	19	6.6	165	11.6	n/a	n/a	8.7	11.1
35 Franklin	4	9.0	13	6.1	n/a	n/a	9.7	5.9
36 Gaston	10	5.5	116	12.9	n/a	n/a	7.0	12.7
37 Gates	0	0.0	2	4.1	n/a	n/a	4.2	4.1
38 Graham	0	0.0	1	2.7	n/a	n/a	3.2	3.3
39 Granville	3	6.7	16	7.6	n/a	n/a	9.9	7.2
40 Greene	1	5.5	7	8.1	n/a	n/a	2.3	7.7
41 Guilford	25	6.4	270	14.3	n/a	n/a	12.8	13.8
42 Halifax	1	1.8	36	12.7	n/a	n/a	7.1	13.6
43 Harnett	2	2.4	18	4.5	n/a	n/a	7.1	4.7
44 Haywood	0	0.0	7	2.8	n/a	n/a	5.4	3.0
45 Henderson	3	3.7	15	3.9	n/a	n/a	4.6	4.3
46 Hertford	1	4.6	11	9.9	n/a	n/a	8.2	10.7
47 Hoke	2	6.7	9	6.4	n/a	n/a	11.8	6.8
48 Hyde	0	0.0	3	11.2	n/a	n/a	0.0	11.8
49 Iredell	2	1.8	26	4.9	n/a	n/a	3.4	4.9
50 Jackson	1	3.4	4	2.8	n/a	n/a	2.9	2.7

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 9 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Acquired Immune Deficiency Syndrome (AIDS)

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	5	4.6	47	9.5	n/a	n/a	7.7	9.1
52 Jones	0	0.0	5	10.7	n/a	n/a	4.5	11.1
53 Lee	3	6.2	16	6.8	n/a	n/a	3.5	7.1
54 Lenoir	10	17.1	55	18.7	n/a	n/a	7.3	19.0
55 Lincoln	1	1.7	11	3.9	n/a	n/a	2.1	3.8
56 McDowell	0	0.0	3	1.6	n/a	n/a	1.7	1.6
57 Macon	0	0.0	3	2.2	n/a	n/a	2.8	2.8
58 Madison	2	10.6	3	3.3	n/a	n/a	2.5	3.7
59 Martin	2	7.8	14	10.9	n/a	n/a	3.9	11.4
60 Mecklenburg	79	12.6	667	22.5	n/a	n/a	16.4	20.6
61 Mitchell	0	0.0	3	4.1	n/a	n/a	1.5	4.4
62 Montgomery	1	4.0	10	8.3	n/a	n/a	6.2	8.3
63 Moore	1	1.4	17	5.0	n/a	n/a	4.3	5.9
64 Nash	6	6.8	39	9.1	n/a	n/a	7.7	8.9
65 New Hanover	8	5.4	83	11.6	n/a	n/a	10.2	11.4
66 Northampton	2	9.6	21	20.2	n/a	n/a	7.5	21.9
67 Onslow	4	2.7	26	3.5	n/a	n/a	5.0	4.7
68 Orange	4	3.7	41	7.7	n/a	n/a	5.4	7.9
69 Pamlico	1	8.3	4	6.7	n/a	n/a	16.1	5.9
70 Pasquotank	0	0.0	12	7.1	n/a	n/a	6.4	7.6
71 Pender	1	2.6	13	7.2	n/a	n/a	6.1	7.2
72 Perquimans	0	0.0	5	9.3	n/a	n/a	0.0	10.4
73 Person	2	6.0	9	5.5	n/a	n/a	5.6	5.4
74 Pitt	14	11.1	85	14.1	n/a	n/a	10.9	14.7
75 Polk	1	6.0	6	7.5	n/a	n/a	4.7	8.0
76 Randolph	0	0.0	23	3.9	n/a	n/a	2.9	3.8
77 Richmond	7	15.4	29	12.8	n/a	n/a	5.6	13.3
78 Robeson	8	7.0	61	10.9	n/a	n/a	7.1	11.7
79 Rockingham	6	6.7	33	7.4	n/a	n/a	3.8	7.5
80 Rowan	7	5.6	54	8.9	n/a	n/a	5.7	9.2
81 Rutherford	1	1.7	14	4.7	n/a	n/a	4.6	5.1
82 Sampson	4	7.5	29	11.2	n/a	n/a	9.9	11.4
83 Scotland	1	2.8	13	7.4	n/a	n/a	10.5	7.7
84 Stanly	1	1.8	13	4.8	n/a	n/a	4.8	4.8
85 Stokes	0	0.0	4	1.9	n/a	n/a	0.6	1.7
86 Surry	0	0.0	6	1.8	n/a	n/a	1.9	1.8
87 Swain	0	0.0	1	1.7	n/a	n/a	5.5	1.9
88 Transylvania	0	0.0	5	3.6	n/a	n/a	5.6	4.1
89 Tyrrell	0	0.0	0	0.0	n/a	n/a	6.7	0.0
90 Union	9	8.2	37	7.2	n/a	n/a	4.7	7.2
91 Vance	5	12.0	39	19.2	n/a	n/a	14.7	19.7
92 Wake	34	5.9	309	11.5	n/a	n/a	9.6	10.6
93 Warren	0	0.0	6	6.6	n/a	n/a	7.4	6.9
94 Washington	2	15.3	10	14.8	n/a	n/a	11.7	15.9
95 Watauga	0	0.0	5	2.5	n/a	n/a	0.5	2.9
96 Wayne	8	7.1	73	13.1	n/a	n/a	9.1	12.7
97 Wilkes	2	3.2	4	1.3	n/a	n/a	1.3	1.2
98 Wilson	9	13.0	63	18.4	n/a	n/a	11.2	18.6
99 Yadkin	0	0.0	3	1.7	n/a	n/a	1.2	1.8
100 Yancey	0	0.0	2	2.5	n/a	n/a	0.0	2.5

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Acquired Immune Deficiency Syndrome

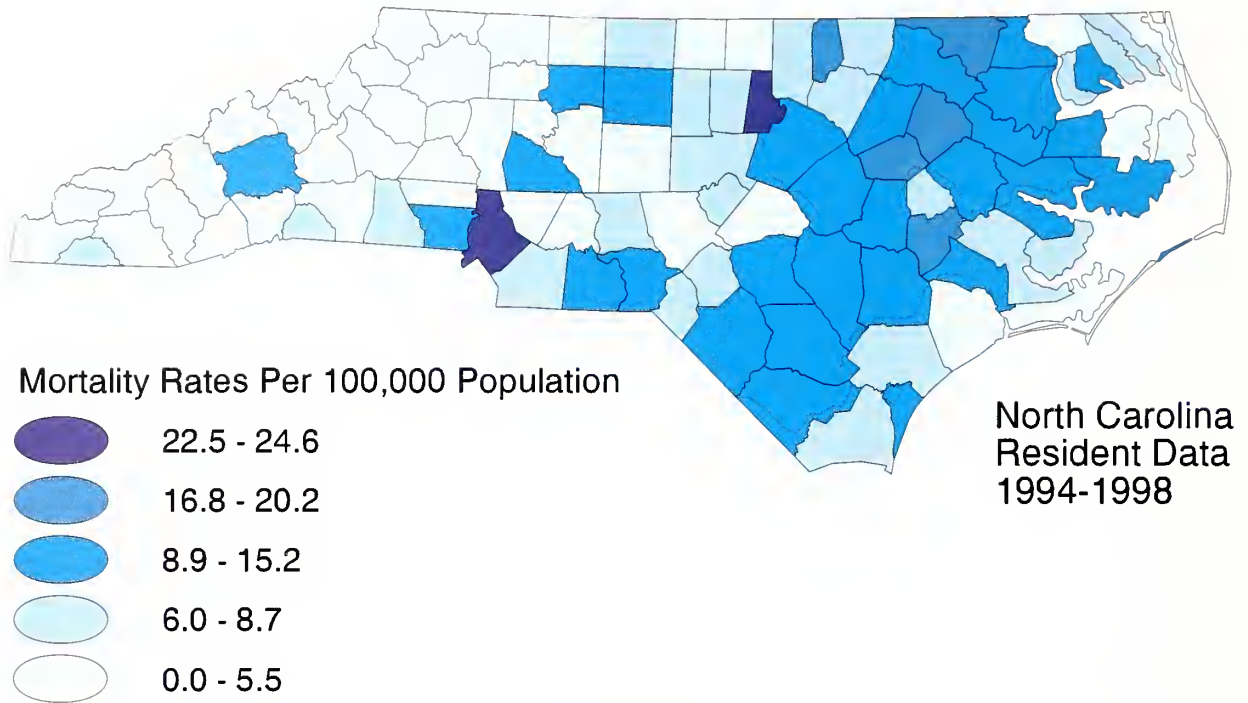


Figure 9.C

Acquired Immune Deficiency Syndrome

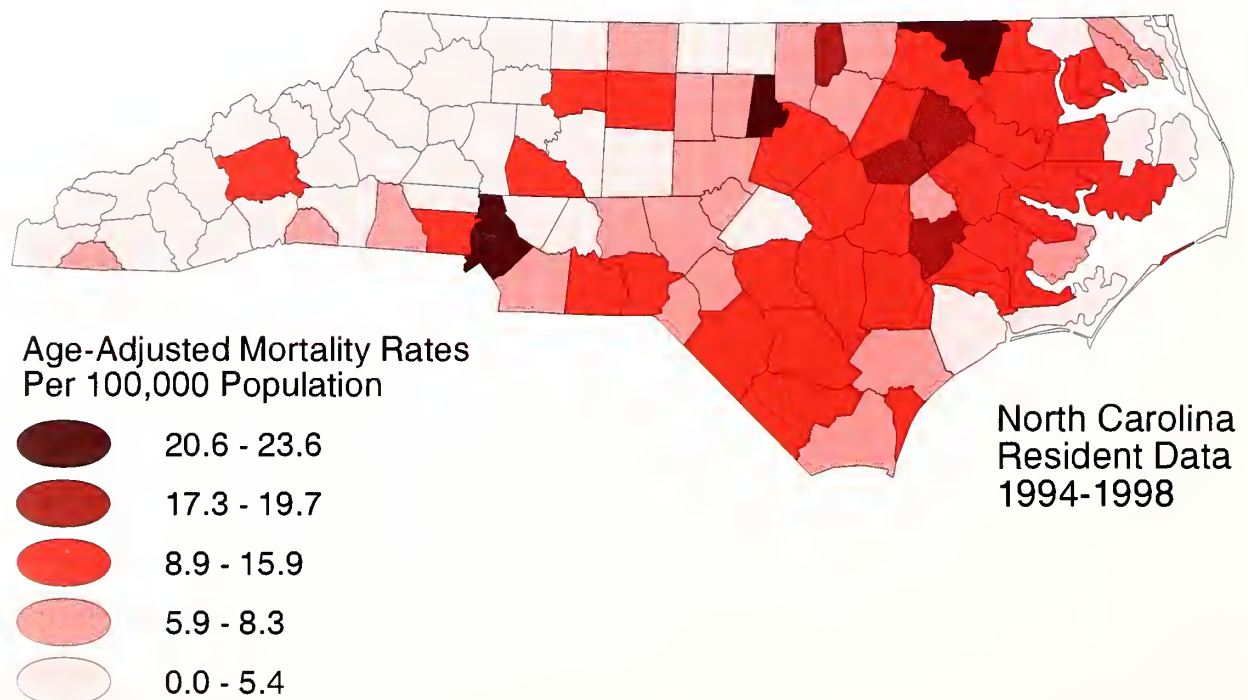


Figure 9.D

Septicemia

Introduction

Septicemia, sometimes called "blood poisoning," is a disease in which the blood is the site of bacterial growth as well as the means of transportation of infection. Because blood is the growth medium, the spread of septicemia is very rapid, making it an extremely dangerous disease. Septicemia is often caused by infection from bacteria such as e-coli, bacteriodes, salmonella, or streptococcus.^{1,2,3}

Differentials and Trends

In 1998, septicemia was ranked as the tenth leading cause of death in North Carolina. A total of 789 residents died from septicemia. This figure represents approximately one percent of all deaths in the state. Mortality rates for septicemia increased consistently from 1979-1987, then dropped significantly in 1988. From 1988 to 1997, the age-adjusted rate of death due to septicemia remained between 9.1 and 10.2 per 100,000 population, then the rate rose to 10.9 in 1998.

During 1994-1998 the number of deaths caused by septicemia was 3,372 with an age-adjusted death rate of 9.8. This statistic reflects a decrease from the age-adjusted death rate of 10.7 during 1984-1988. The age-adjusted death rates for each race-sex group are as follows: white males, 8.9; minority males, 19.6; white females, 7.7; and minority females, 15.2.

Risk Factors

Primarily at risk for acquiring septicemia are people whose health is already compromised by a preexisting health problem (such as AIDS, cancer, cirrhosis, or diabetes) or by recent surgical or medical procedures (i.e. central catheterization, parenteral nutrition). It often occurs among people already admitted to the hospital for the treatment of other conditions.³

Age also appears to be a risk factor for septicemia. Both the very young and the elderly appear to be at greatest risk for septicemia death in North Carolina.^{3,4} In 1998, this disease was ranked as the sixth leading cause of death for children less than one year old and the seventh leading cause of death for those ages one through four years of age. In the same year, for individuals ages 65 and over, septicemia is ranked as the ninth leading cause of death.

Males appear to be more likely to develop septicemia than females. According to recent research, males are more likely to develop opportunistic infections following surgery for trauma than females.⁵ As shown in Figure 10.B, in North Carolina from 1979-1998, males had an age-adjusted septicemia mortality rate that was slightly higher than that for females.

Minorities have higher mortality from septicemia. From 1979-1998, age adjusted mortality rates for septicemia were consistently higher for minorities than for whites in North Carolina (refer to Figure 10.A).

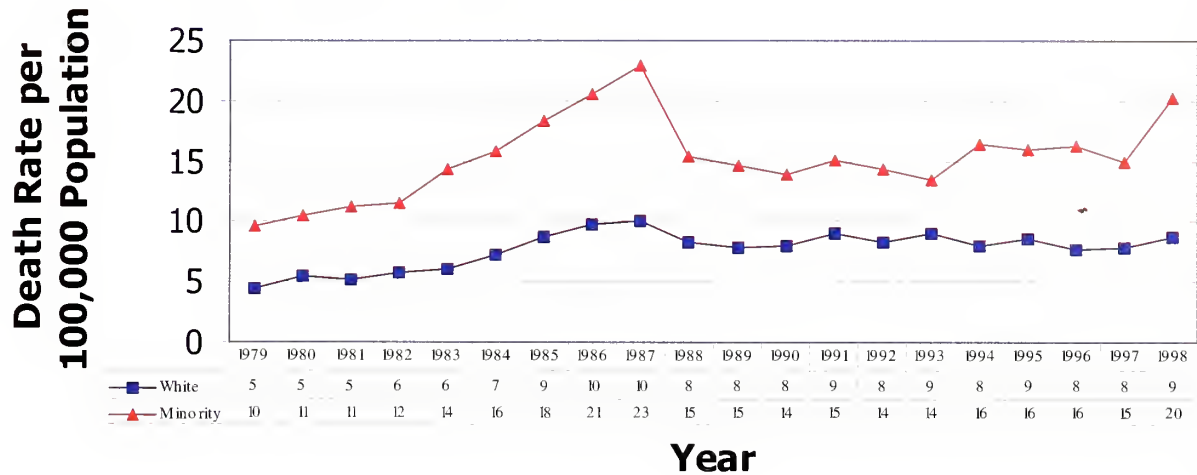
Geographic Patterns

Unadjusted and age-adjusted death rates for septicemia (Figures 10.C and 10.D) reveal that septicemia mortality is higher in North Carolina's eastern and western counties. The Piedmont region has a lower rate of septicemia deaths.

References

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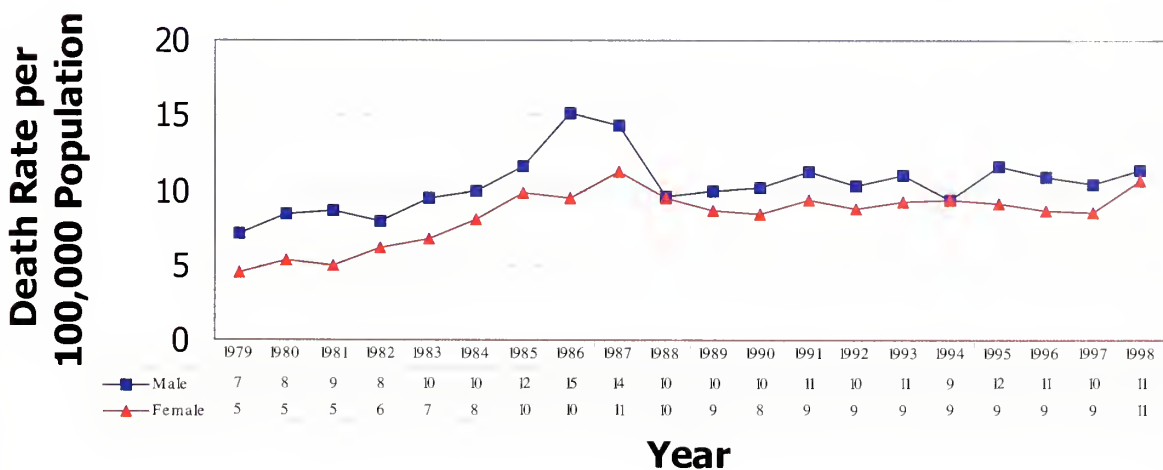
Septicemia: North Carolina Resident Age-Adjusted* Death Rates by Race 1979-1998



*U.S. 2000 standard population

Figure 10.A

Septicemia: North Carolina Resident Age-Adjusted* Death Rates by Sex 1979-1998



*U.S. 2000 standard population

Figure 10.B

TABLE 10
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Septicemia

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	789	10.5	3,372	9.2	6.7	10.7	9.6	9.8
1 Alamance	23	18.9	69	11.7	7.0	10.8	9.9	10.3
2 Alexander	5	15.7	10	6.5	3.2	12.7	8.9	7.2
3 Alleghany	2	20.3	3	6.2	5.0	9.2	11.3	3.8
4 Anson	1	4.2	7	5.9	8.7	9.4	6.9	4.8
5 Ashe	5	21.1	14	12.0	9.2	7.2	6.0	8.3
6 Avery	2	13.1	6	7.9	4.9	6.9	4.8	6.7
7 Beaufort	2	4.6	23	10.6	6.5	9.0	18.9	9.2
8 Bertie	5	25.0	16	15.7	5.7	9.8	11.0	15.6
9 Bladen	6	19.5	29	19.3	5.8	19.7	11.8	17.1
10 Brunswick	4	5.9	19	6.0	8.2	5.6	9.3	6.4
11 Buncombe	7	3.6	84	8.8	4.3	8.2	7.5	7.1
12 Burke	8	9.5	40	9.7	2.5	7.6	4.7	9.4
13 Cabarrus	11	9.1	39	6.9	4.7	10.9	9.0	7.0
14 Caldwell	7	9.3	23	6.2	3.9	7.5	6.5	6.3
15 Camden	0	0.0	1	3.2	0.0	7.9	4.9	2.5
16 Carteret	3	5.1	13	4.5	6.9	7.2	7.8	4.4
17 Caswell	1	4.5	14	12.9	4.5	4.1	6.9	11.0
18 Catawba	14	10.6	55	8.6	6.7	8.7	6.7	9.1
19 Chatham	3	6.5	18	8.2	6.2	13.9	10.3	7.5
20 Cherokee	3	13.2	17	15.4	8.1	9.8	6.7	10.9
21 Chowan	0	0.0	4	5.7	12.5	6.2	8.0	4.1
22 Clay	1	12.1	4	10.1	7.5	1.7	4.1	7.5
23 Cleveland	15	16.3	54	12.0	9.1	9.3	10.5	11.1
24 Columbus	7	13.4	39	15.1	5.7	19.0	16.8	14.5
25 Craven	15	16.9	70	16.1	12.8	15.7	9.8	19.7
26 Cumberland	17	5.8	85	5.8	6.5	12.5	13.7	10.1
27 Currituck	4	23.3	12	14.8	4.3	8.7	14.8	16.2
28 Dare	1	3.6	11	8.3	6.3	12.9	12.3	10.8
29 Davidson	13	9.2	49	7.1	6.2	7.9	7.6	7.3
30 Davie	4	12.4	15	9.8	6.9	13.4	10.3	8.6
31 Duplin	4	9.0	21	9.7	5.5	11.8	7.5	9.3
32 Durham	25	12.5	114	11.7	9.7	16.0	12.8	14.3
33 Edgecombe	7	12.8	46	16.5	8.5	10.9	14.4	17.1
34 Forsyth	35	12.1	148	10.4	11.2	14.9	12.0	10.6
35 Franklin	8	18.0	36	16.9	10.5	13.4	4.8	17.5
36 Gaston	27	14.9	81	9.0	5.1	8.5	8.8	9.6
37 Gates	0	0.0	4	8.1	7.4	18.1	11.5	7.4
38 Graham	0	0.0	1	2.7	6.5	12.1	5.2	2.2
39 Granville	5	11.2	26	12.3	4.8	18.4	12.4	12.7
40 Greene	4	21.8	12	13.9	7.8	10.5	11.0	14.1
41 Guilford	53	13.7	162	8.6	6.2	8.6	7.4	8.9
42 Halifax	10	18.0	48	17.0	6.6	14.7	11.7	16.4
43 Harnett	6	7.2	34	8.6	5.4	8.6	13.5	9.6
44 Haywood	4	7.7	22	8.7	2.4	6.6	7.9	6.0
45 Henderson	3	3.7	36	9.3	4.6	4.3	6.0	5.8
46 Hertford	4	18.6	9	8.1	12.9	12.8	13.6	7.7
47 Hoke	2	6.7	14	9.9	2.6	11.7	9.2	12.8
48 Hyde	0	0.0	1	3.7	0.0	3.0	9.3	2.8
49 Iredell	7	6.2	41	7.7	3.0	7.3	12.2	7.4
50 Jackson	2	6.8	20	13.8	3.9	9.7	14.8	12.3

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 10 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Septicemia

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	11	10.2	40	8.0	5.9	8.3	8.6	8.9
52 Jones	3	32.4	9	19.3	13.3	20.3	13.1	19.1
53 Lee	9	18.5	34	14.4	7.1	9.4	6.6	14.8
54 Lenoir	7	11.9	29	9.8	4.4	10.1	11.3	9.2
55 Lincoln	5	8.5	18	6.3	3.4	6.4	10.1	7.3
56 McDowell	3	7.5	10	5.2	4.0	8.4	7.6	4.7
57 Macon	5	17.8	17	12.6	9.2	7.3	10.5	7.2
58 Madison	0	0.0	17	18.7	2.4	16.5	27.0	14.3
59 Martin	8	31.2	25	19.4	3.0	13.6	11.4	17.5
60 Mecklenburg	49	7.8	247	8.3	7.7	10.8	8.1	11.1
61 Mitchell	1	6.8	12	16.4	10.0	12.0	8.2	12.4
62 Montgomery	4	16.2	11	9.1	5.8	14.0	10.4	9.1
63 Moore	6	8.5	29	8.5	6.0	7.1	4.4	6.1
64 Nash	12	13.6	56	13.1	8.7	15.0	8.3	14.2
65 New Hanover	7	4.7	39	5.5	6.7	12.3	6.7	5.6
66 Northampton	3	14.5	13	12.5	13.5	15.2	10.9	10.2
67 Onslow	4	2.7	25	3.4	13.2	8.9	10.9	7.7
68 Orange	10	9.2	28	5.3	12.4	17.4	9.7	7.5
69 Pamlico	1	8.3	6	10.0	0.0	10.6	8.5	7.3
70 Pasquotank	6	17.3	15	8.8	8.7	3.2	12.0	8.4
71 Pender	3	7.9	12	6.7	3.1	6.3	7.7	6.4
72 Perquimans	0	0.0	4	7.4	4.9	10.7	5.4	5.9
73 Person	8	24.0	25	15.4	2.4	7.7	9.6	13.9
74 Pitt	12	9.5	74	12.3	7.6	15.4	14.2	16.3
75 Polk	3	18.0	7	8.7	1.0	5.3	3.6	5.9
76 Randolph	9	7.2	42	7.1	4.5	8.4	8.3	7.4
77 Richmond	2	4.4	21	9.2	6.3	14.8	10.6	9.1
78 Robeson	15	13.1	65	11.6	7.2	10.8	10.1	14.0
79 Rockingham	17	19.0	54	12.2	5.5	14.2	7.7	10.7
80 Rowan	21	16.8	67	11.1	4.4	6.7	6.5	9.6
81 Rutherford	13	21.6	36	12.1	7.2	6.7	6.6	10.2
82 Sampson	8	15.0	38	14.7	6.5	14.3	11.9	13.8
83 Scotland	7	19.9	18	10.3	5.8	16.7	16.8	12.2
84 Stanly	7	12.6	22	8.1	4.4	6.3	6.6	7.5
85 Stokes	4	9.3	20	9.5	12.1	12.6	11.8	10.3
86 Surry	8	11.8	36	10.9	11.4	12.1	10.3	9.3
87 Swain	0	0.0	12	20.3	8.3	7.7	22.5	17.2
88 Transylvania	3	10.6	7	5.1	6.2	5.4	4.7	3.5
89 Tyrrell	0	0.0	1	5.3	17.5	14.6	9.0	3.7
90 Union	8	7.3	43	8.4	2.7	6.5	7.4	12.1
91 Vance	6	14.4	29	14.3	7.5	16.9	12.0	14.9
92 Wake	41	7.1	164	6.1	7.2	13.8	9.6	9.8
93 Warren	2	10.6	11	12.1	8.4	23.7	9.5	9.5
94 Washington	1	7.6	6	8.9	8.4	15.8	6.5	8.1
95 Watauga	0	0.0	7	3.5	4.4	10.7	8.3	4.2
96 Wayne	10	8.8	33	5.9	5.4	9.4	14.6	7.2
97 Wilkes	10	15.8	50	16.0	5.6	13.7	14.4	15.5
98 Wilson	13	18.7	47	13.7	3.4	8.1	8.9	13.9
99 Yadkin	7	19.6	17	9.9	5.1	13.5	29.0	8.8
100 Yancey	2	12.1	5	6.1	7.0	6.9	9.2	4.4

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Septicemia

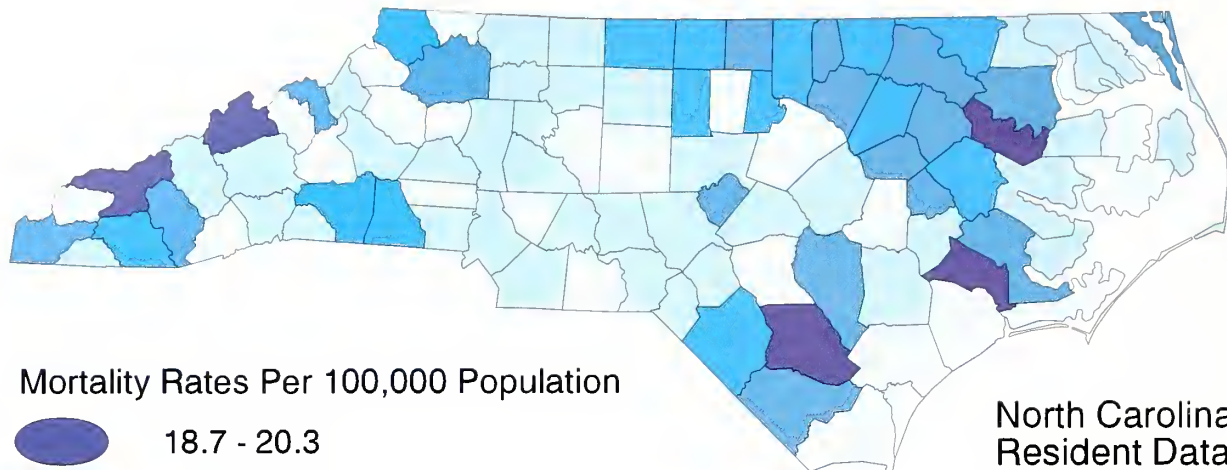


Figure 10.C

Septicemia

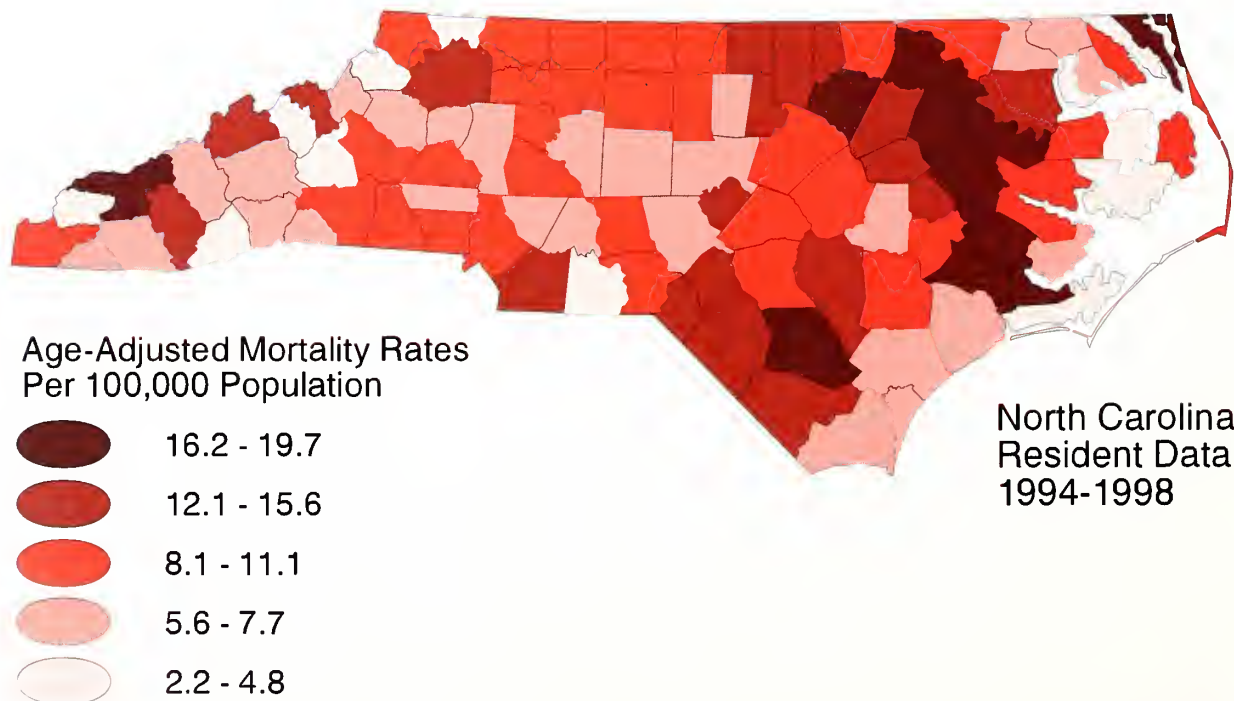


Figure 10.D

Diabetes Mellitus

Introduction

Diabetes mellitus is a disease characterized by high levels of blood glucose resulting from defects in insulin secretion, insulin action, or both. Diabetes is classified into two main types: Type 1 and Type 2. Type 1 diabetes (insulin-dependent) affects five to ten percent of those with diabetes and most often occurs during childhood or adolescence. Type 2 diabetes (non-insulin-dependent) is the more common type, affecting ninety to ninety-five percent of those with diabetes. Even though the details of this disease have been known for a long time, the incidence of diabetes has gradually increased during this century.¹ Diabetes and its complications occur among Americans of all ages and racial/ethnic groups, however the elderly and certain racial/ethnic groups are more commonly affected by the disease.² It is estimated that approximately 18 percent of Americans ages 65 and over have diabetes.

During the past decade there has been a significant increase in the incidence of diabetes to such an extent that it is now considered to have reached epidemic proportions. It is a major public health problem and a leading cause of death and disability in the United States. According to the National Center for Health Statistics, 15.7 million people – about six percent of the population – have diabetes. Of these, approximately 10.3 million people have been diagnosed with diabetes and it is estimated that the rest harbor the syndromes of the disease but remain undiagnosed.

Diabetes mellitus is the fourth leading cause of death in the United States and a major cause of kidney, cerebrovascular, and heart disease.³ Adults with diabetes have heart disease death rates about two to four times as high as that of adults without diabetes. In addition, the risk of stroke is two to four times greater in people with diabetes. Diabetes is also the leading cause of end-stage renal disease, accounting for about 40 percent of new cases. Diabetes can cause other acute life-threatening events, such as diabetic ketoacidosis and coma. In addition, people with diabetes are more susceptible to and are more likely to die from other illnesses including pneumonia and influenza.⁴

Differentials and Trends

Diabetes is the sixth leading underlying cause of death in North Carolina – resulting in more than 1,900 deaths in 1998. Death rates have increased over time for all ages and races.

The death rate for diabetes was higher as a leading cause of death among males than among females. In 1998, age-adjusted diabetes death rates (based on diabetes as the underlying cause of death) were higher among minorities than among whites. For 1994-98, age-adjusted death rates per 100,000 were 53.5 for minority women; 16.8 for white women; 51.2 for minority men; and 22.8 for white men. The rate for minority males was 2.2 times that for white males, while the minority female rate was 3 times the white female rate.

The annual number of deaths for which diabetes was the underlying cause increased from 1,597 in 1994 to 1,963 in 1998. By 1998, the unadjusted diabetes death rate was 15 percent higher than in 1994 (26.0 per 100,000 vs. 22.6 per 100,000, respectively). The age-adjusted death rate increased from 16.7 in 1979-83 to 25.3 in 1994-98, a rise of more than 51 percent.

While diabetes is recorded as the underlying cause of death for nearly 2,000 deaths of North Carolinians per year, it is a significant contributing factor to several times as many deaths from other underlying causes, such as heart disease and stroke.

Risk Factors

Risk factors are less well defined for type 1 diabetes than for type 2 diabetes, but autoimmune, genetic, and environmental factors are involved in the development of this type of diabetes.

Risk factors for type 2 diabetes include older age, obesity, family history of diabetes, prior history of gestational diabetes, impaired glucose tolerance, physical inactivity, and race/ethnicity. African Americans, Hispanic/Latino Americans, American Indians, and some Asian Americans and Pacific Islanders are at particularly high risk for type 2 diabetes.⁴

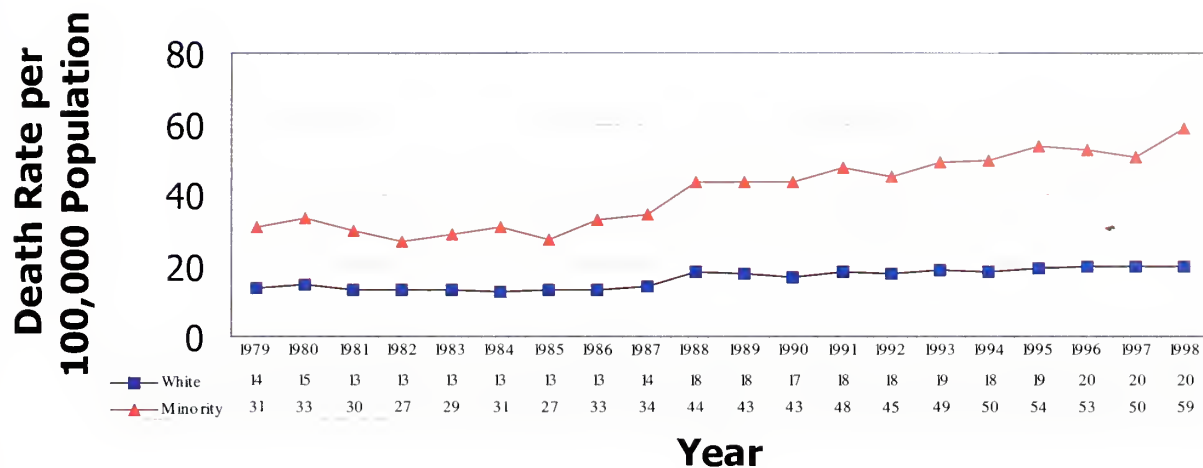
Geographic Patterns

During 1994-1998 there was considerable variability among the counties with regard to unadjusted death rates for diabetes (Figure 11.C). This map shows that residents of the eastern and, to a lesser degree, western counties, are at relatively high risk of death from diabetes. Even after controlling for the impact of age (Figure 11.D) the eastern counties show higher diabetes mortality rates. This may be due to higher concentration of minorities in these counties.

References

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3. Casey DE, Egede LE. Effect of a disease management tool on resident's compliance with American Diabetes Association standard of care for type 2 diabetes mellitus. *Maryland Medical Journal* 1998; 48:119-21.
4. Centers for Disease Control and Prevention. Atlanta, GA: U.S. Department of Health and Human Services, 1997. <http://www.cdc.gov/diabetes/pubs/glance.htm>

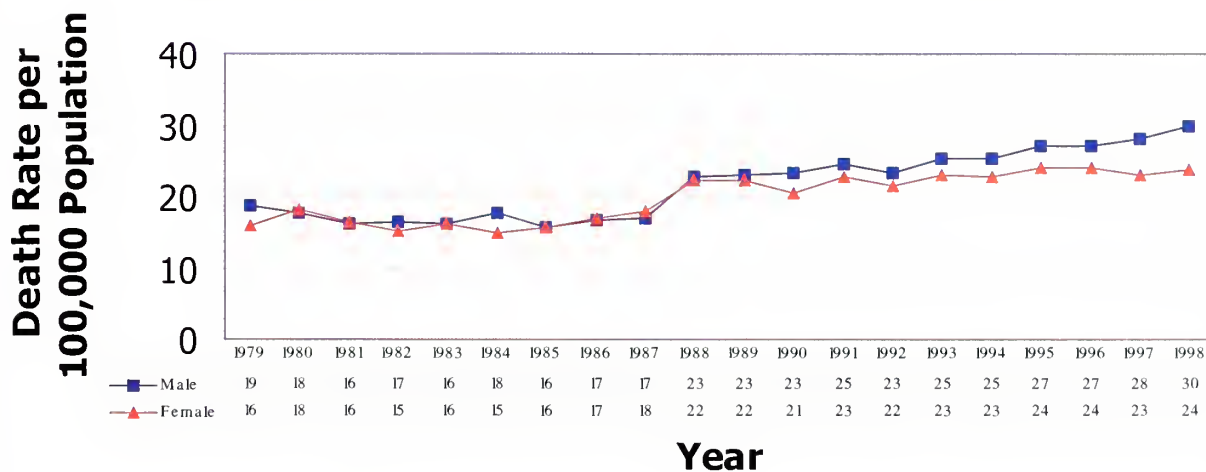
Diabetes Mellitus: North Carolina Resident Age-Adjusted* Death Rates by Race 1979-1998



*U.S. 2000 standard population

Figure 11.A

Diabetes Mellitus: North Carolina Resident Age-Adjusted* Death Rates by Sex 1979-1998



*U.S. 2000 standard population

Figure 11.B

TABLE 11
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Diabetes Mellitus

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	1,963	26.0	8,956	24.5	16.7	18.1	22.9	25.3
1 Alamance	33	27.1	190	32.3	14.8	21.5	29.9	28.2
2 Alexander	5	15.7	27	17.6	9.3	8.8	14.0	18.3
3 Alleghany	4	40.6	12	24.8	5.8	6.8	7.3	15.7
4 Anson	7	29.1	30	25.1	11.0	15.2	19.5	22.4
5 Ashe	4	16.9	38	32.6	19.2	13.7	13.3	24.2
6 Avery	1	6.5	8	10.5	6.2	13.7	19.2	8.8
7 Beaufort	10	23.0	78	36.0	28.5	23.7	37.2	30.9
8 Bertie	14	69.9	64	62.8	27.0	26.5	35.5	59.7
9 Bladen	15	48.7	58	38.6	12.8	27.5	27.6	34.3
10 Brunswick	15	22.3	82	26.1	8.7	14.9	22.7	24.1
11 Buncombe	43	22.2	221	23.3	11.5	14.7	17.4	19.1
12 Burke	26	30.9	116	28.2	17.3	20.7	24.6	26.9
13 Cabarrus	27	22.4	129	22.7	10.9	9.9	18.2	22.9
14 Caldwell	19	25.2	94	25.3	33.1	21.7	29.5	25.2
15 Camden	1	15.7	10	31.7	10.1	32.2	18.3	28.9
16 Carteret	10	16.9	66	22.7	16.1	22.1	19.7	20.5
17 Caswell	5	22.3	29	26.7	22.6	23.0	29.9	22.4
18 Catawba	32	24.3	155	24.2	17.5	18.5	19.8	24.7
19 Chatham	11	23.9	52	23.6	13.8	10.7	28.6	20.4
20 Cherokee	8	35.1	27	24.4	13	8.7	16.2	17.1
21 Chowan	5	34.8	16	22.6	12.0	17.9	18.5	17.0
22 Clay	0	0.0	11	27.9	18.0	10.6	3.0	17.3
23 Cleveland	33	35.9	137	30.5	21.9	21.5	25.2	28.0
24 Columbus	8	15.3	51	19.7	24.0	17.7	23.8	18.6
25 Craven	19	21.3	95	21.8	14.5	13.3	15.6	23.7
26 Cumberland	78	26.6	308	21.0	15.7	22.3	29.5	34.6
27 Currituck	3	17.5	12	14.8	15.0	27.0	17.3	15.6
28 Dare	2	7.1	10	7.5	12.9	11.4	12.3	8.2
29 Davidson	26	18.4	161	23.3	16.6	15.8	18.4	23.4
30 Davie	15	46.6	57	37.3	16.7	15.5	21.3	32.7
31 Duplin	12	27.1	71	32.8	25.7	19.7	25.3	30.1
32 Durham	49	24.4	241	24.7	17.8	17.7	23.6	30.4
33 Edgecombe	12	21.9	89	31.9	18.8	17.7	28.4	32.8
34 Forsyth	89	30.7	401	28.3	15.5	22.2	24.1	28.4
35 Franklin	20	45.0	73	34.3	19.3	16.8	29.5	35.0
36 Gaston	64	35.4	246	27.4	17.6	16.2	19.6	28.2
37 Gates	4	40.0	15	30.4	6.3	22.4	14.8	27.8
38 Graham	2	26.8	21	56.2	14.0	2.5	27.6	45.2
39 Granville	21	47.2	63	29.9	21.3	22.2	24.8	30.6
40 Greene	9	49.1	28	32.4	14.1	20.9	22.4	31.5
41 Guilford	79	20.4	390	20.7	14.7	17.0	20.6	21.2
42 Halifax	20	36.1	98	34.7	26.6	20.6	31.6	32.3
43 Harnett	28	33.5	110	27.8	27.8	15.5	28.3	30.0
44 Haywood	17	32.9	63	24.9	11.2	13.7	19.1	16.9
45 Henderson	21	26.0	78	20.1	9.6	10.1	9.5	13.3
46 Hertford	12	55.7	48	43.4	21.5	20.3	35.4	39.1
47 Hoke	8	26.6	34	24.1	36.3	21.0	21.6	29.5
48 Hyde	2	34.8	13	48.7	22.6	14.0	37.0	38.6
49 Iredell	22	19.4	97	18.2	20.4	14.8	17.2	17.5
50 Jackson	11	37.2	36	24.8	12.0	19.1	20.6	22.5

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 11 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Diabetes Mellitus

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	24	22.3	111	22.3	20.2	16.1	19.1	23.2
52 Jones	2	21.6	13	27.9	19.3	18.2	25.8	25.0
53 Lee	21	43.1	79	33.6	26.1	13.0	26.7	32.5
54 Lenoir	22	37.5	83	28.2	17.7	17.8	30.7	25.9
55 Lincoln	16	27.1	62	21.8	17.5	21.8	12.5	23.3
56 McDowell	16	39.9	64	33.4	13.1	16.7	24.3	28.9
57 Macon	10	35.5	51	37.9	8.8	11.5	21.1	23.8
58 Madison	1	5.3	12	13.2	13.7	23.9	25.1	10.1
59 Martin	10	39.0	51	39.6	25.5	27.0	37.8	36.1
60 Mecklenburg	118	18.9	561	18.9	14.8	21.1	23.4	24.9
61 Mitchell	3	20.5	26	35.5	9.7	25.3	22.0	25.7
62 Montgomery	5	20.2	38	31.4	18.6	12.7	22.7	31.5
63 Moore	11	15.5	47	13.8	11.7	11.9	12.6	9.2
64 Nash	28	31.8	115	26.9	13.8	18.5	26.1	28.0
65 New Hanover	39	26.3	150	21.0	13.3	18.9	23.0	21.3
66 Northampton	9	43.4	41	39.5	21.6	23.2	32.6	30.8
67 Onslow	21	14.1	73	9.8	17.6	16.4	18.5	21.3
68 Orange	19	17.4	70	13.1	15.2	15.8	21.9	18.2
69 Pamlico	5	41.3	23	38.5	11.6	10.5	17.4	30.2
70 Pasquotank	12	34.5	49	28.9	14.0	20.0	21.5	28.1
71 Pender	11	28.9	63	35.1	9.8	11.4	26.3	32.1
72 Perquimans	6	54.8	17	31.6	7.6	4.7	13.9	24.3
73 Person	11	33.0	49	30.2	14.6	19.3	14.2	26.9
74 Pitt	32	25.3	154	25.5	15.4	23.2	34.0	32.9
75 Polk	7	42.0	25	31.1	10.3	14.8	20.9	19.1
76 Randolph	20	16.1	120	20.2	13.1	14.5	18.6	20.6
77 Richmond	13	28.6	69	30.3	16.7	24.5	30.5	28.1
78 Robeson	60	52.4	269	48.0	25.3	33.7	40.2	57.3
79 Rockingham	25	27.9	120	27.0	17.2	16.3	26.3	24.0
80 Rowan	37	29.7	176	29.1	22.0	16.8	20.7	25.5
81 Rutherford	4	6.7	50	16.9	8.5	15.9	19.1	14.6
82 Sampson	26	48.8	78	30.3	20.6	17.3	24.1	27.2
83 Scotland	14	39.8	70	40.1	32.2	28.3	34.9	45.7
84 Stanly	30	54.0	104	38.1	15.6	22.5	28.5	34.3
85 Stokes	9	20.8	34	16.2	13.0	12.4	17.5	17.1
86 Surry	20	29.4	95	28.8	14.9	20.6	18.2	24.1
87 Swain	9	74.0	33	55.9	22.5	31.6	38.6	47.3
88 Transylvania	7	24.7	35	25.4	14.3	11.9	15.4	17.5
89 Tyrrell	0	0.0	5	26.5	29.1	9.7	23.1	20.8
90 Union	18	16.3	94	18.4	13.4	17.2	24.5	25.0
91 Vance	20	48.0	99	48.7	21.8	23.9	35.3	49.4
92 Wake	111	19.3	446	16.6	16.8	17.6	23.5	25.6
93 Warren	6	31.7	33	36.2	18.1	13.7	18.6	26.8
94 Washington	3	22.9	16	23.7	27.5	16.7	18.0	21.8
95 Watauga	5	12.2	22	10.9	14.0	9.9	9.9	12.8
96 Wayne	40	35.3	165	29.5	19.1	26.0	28.7	35.5
97 Wilkes	18	28.4	61	19.5	15.1	13.2	17.4	17.6
98 Wilson	16	23.1	110	32.2	24.7	21.9	35.5	32.1
99 Yadkin	12	33.7	53	30.8	27.8	10.8	19.0	26.3
100 Yancey	0	0.0	13	16.0	9.7	16.9	26.1	11.6

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Diabetes Mellitus

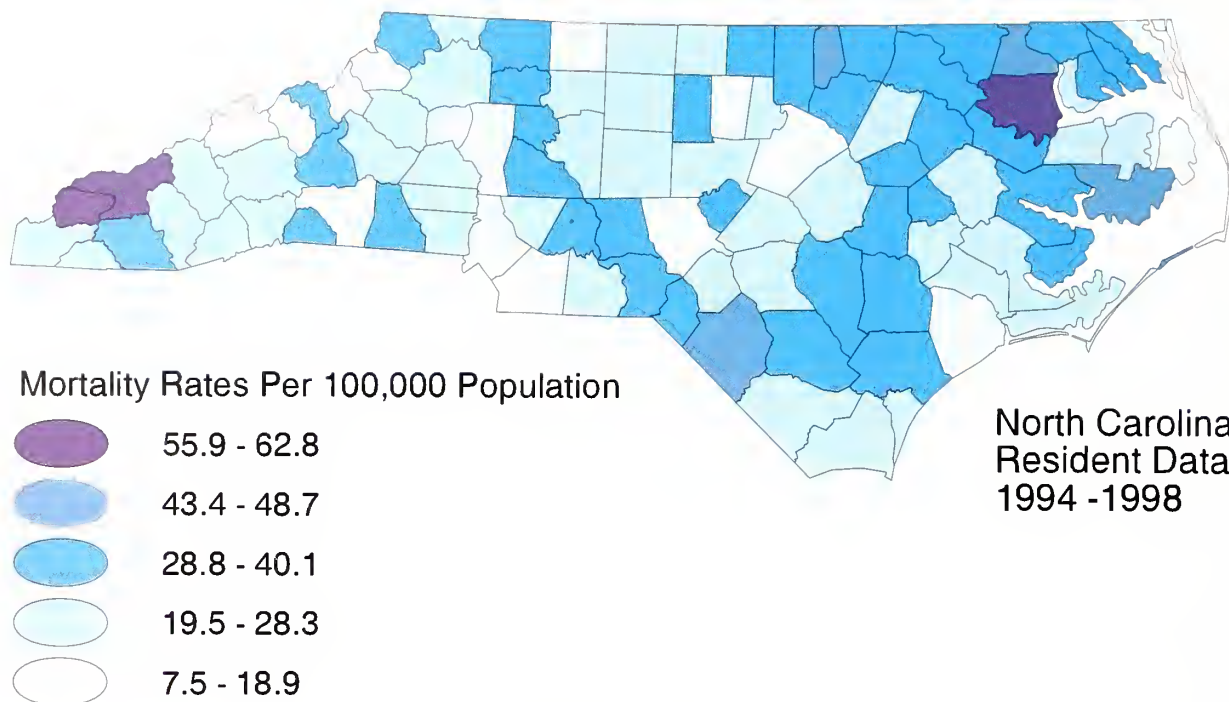


Figure 11.C

Diabetes Mellitus

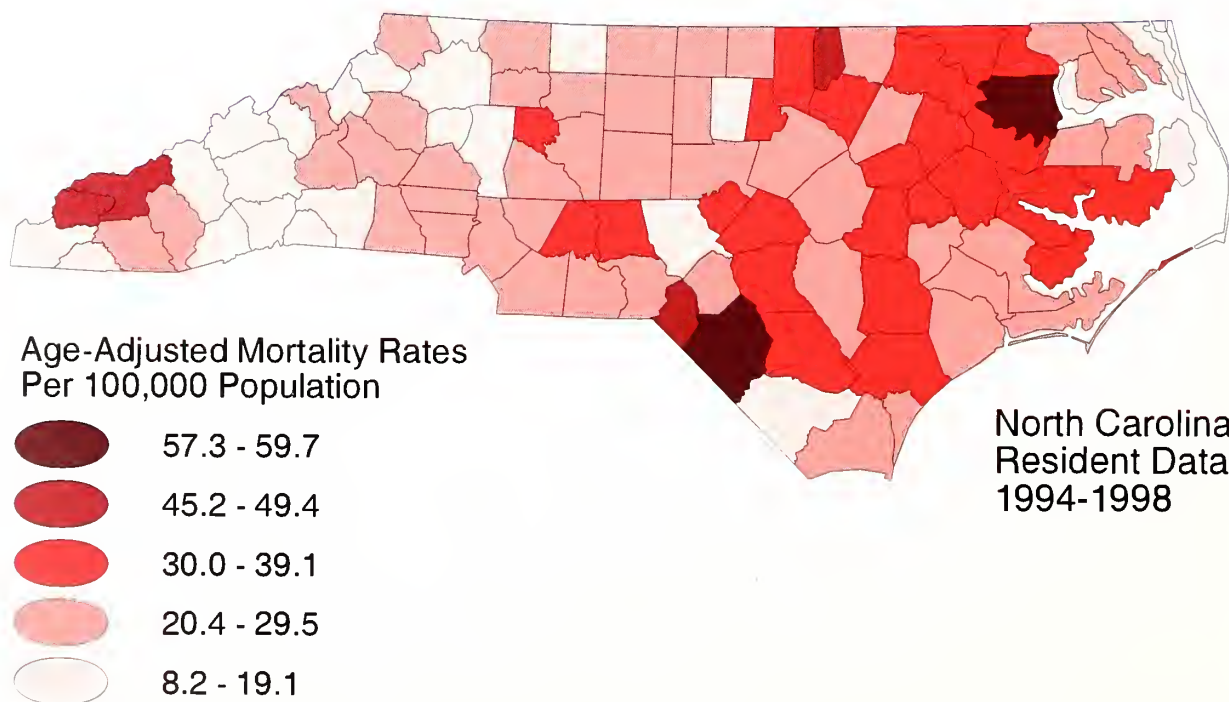


Figure 11.D

Pneumonia and Influenza

Introduction

In 1998 a total of 2,688 North Carolinians died from pneumonia (viral or bacterial) or influenza. Pneumonia and influenza was the fifth leading cause of death in 1998 when ranked on the basis of unadjusted mortality rates. Race-sex-specific rankings reveal that during 1994-98 pneumonia and influenza was the fifth leading cause of death for white males, fifth for white females, ninth for minority males, and fifth for minority females. The 1997 North Carolina unadjusted mortality rate for pneumonia and influenza was nearly the same as the 1997 United States rate.¹

Differentials and Trends

The unadjusted mortality rate of 35.6 deaths per 100,000 population in 1998 was 8 percent higher than the 1997 rate of 33.1. A comparison of 1988 and 1998 reveals that the pneumonia and influenza rate rose 20 percent, from 29.7 to 35.6.

After adjusting for age (year 2000 standard) the upward trend in pneumonia and influenza mortality rates is dampened significantly. Only a three percent increase is noted when comparing 1988 and 1998 age-adjusted rates, suggesting that much of the increase in unadjusted rates is due to changes in age structure of the population. North Carolina's elderly population has grown more rapidly than the rest of its population, and is expected to increase by 70 percent in the next twenty years.²

The age-adjusted pneumonia and influenza death rate for 1994-98 was highest for minority males (55.1), followed by white males (47.9), white females (30.8), and minority females (26.8).

Risk Factors

Persons most at risk of dying from pneumonia or influenza are those over age 50, those with chronic diseases of the heart, liver, lungs, kidneys, or those with diabetes.³ The rate of pneumonia and influenza mortality increases with age, regardless of race or sex. In the period 1994-98 nearly 88 percent of such deaths were to persons 65 or older and pneumonia and influenza was the fifth leading cause of death in this age group.

Respiratory infections in the form of pneumonia or pneumonitis are also quite common in the neonatal period and are a significant cause of morbidity and mortality in the newborn.⁴ Pneumonia and influenza is the sixth leading cause of death in infants.

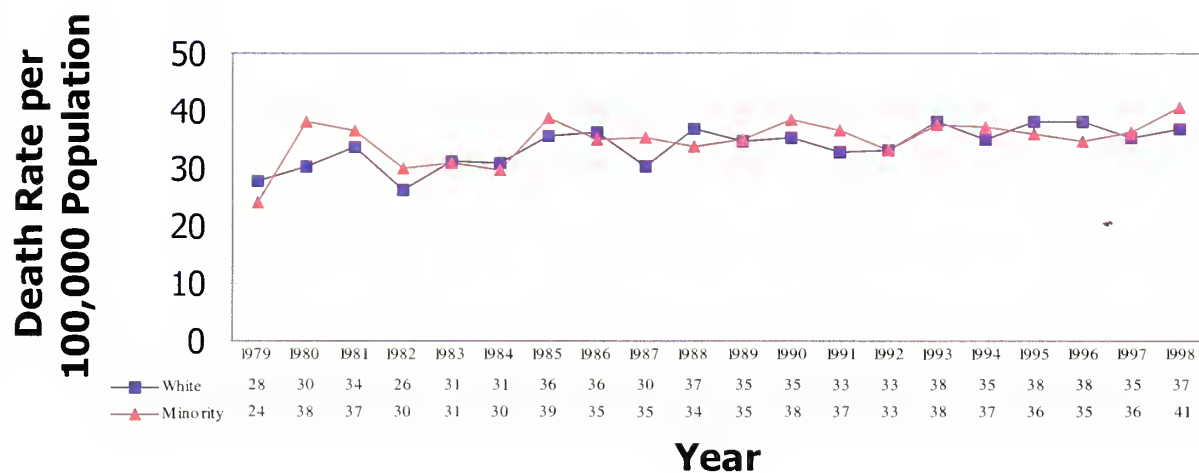
Geographic Patterns

Figures 12.C and 12.D depict the county unadjusted and age-adjusted 1994-98 rates for pneumonia and influenza. As shown in Figure 12.C, most of the 100 North Carolina counties have relatively low unadjusted mortality rates. After adjusting for age, (see Figure 12.D), this pattern is not changed much. There is a relatively even geographic distribution of pneumonia and influenza death rates, with scattered higher-rate counties.

References

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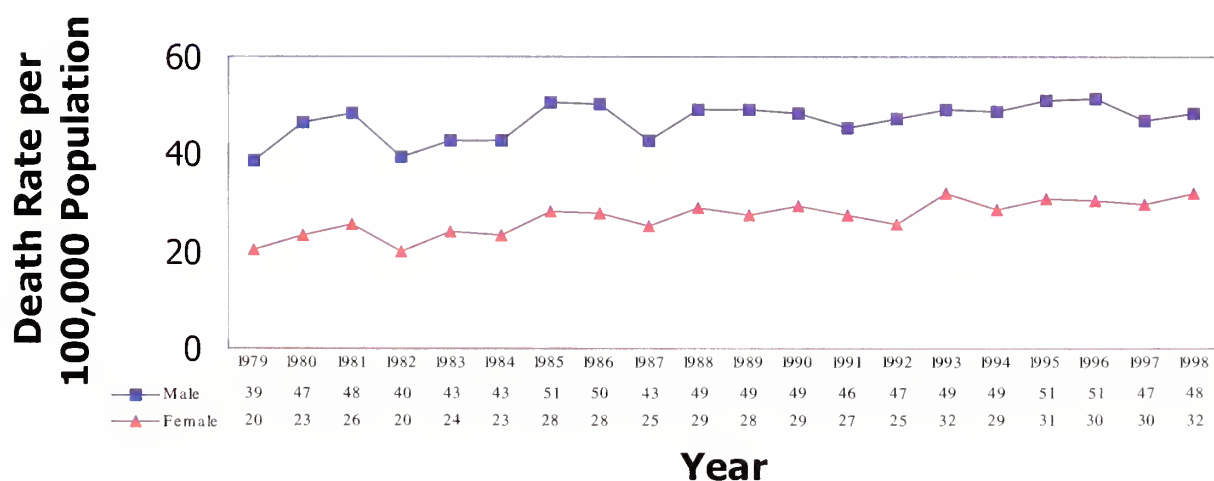
Pneumonia and Influenza: North Carolina Resident Age-Adjusted* Death Rates by Race 1979-1998



*U.S. 2000 standard population

Figure 12.A

Pneumonia and Influenza: North Carolina Resident Age-Adjusted* Death Rates by Sex 1979-1998



*U.S. 2000 standard population

Figure 12.B

TABLE 12
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Pneumonia and Influenza

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	2,688	35.6	12,309	33.7	30.3	34.2	35.2	36.8
1 Alamance	42	34.5	164	27.9	24.2	20.2	24.1	24.5
2 Alexander	12	37.6	64	41.7	22.8	43.6	52.5	50.3
3 Alleghany	4	40.6	49	101.3	48.4	72.0	42.4	64.9
4 Anson	6	25.0	60	50.2	49.9	55.3	57.3	42.6
5 Ashe	12	50.6	54	46.3	20.5	23.5	25.4	33.4
6 Avery	14	91.4	58	76.1	42.2	50.4	57.3	64.1
7 Beaufort	16	36.7	84	38.8	39.8	43.5	50.9	33.8
8 Bertie	5	25.0	44	43.2	29.9	37.0	40.5	41.6
9 Bladen	20	65.0	77	51.2	36.4	43.0	54.8	46.1
10 Brunswick	19	28.2	88	28.0	24.8	40.9	35.4	31.3
11 Buncombe	82	42.4	403	42.4	37.5	37.1	35.2	33.6
12 Burke	34	40.4	166	40.4	37.6	30.7	28.2	40.2
13 Cabarrus	49	40.6	272	47.9	39.3	44.5	47.6	50.5
14 Caldwell	25	33.2	104	28.0	28.6	33.4	29.4	29.8
15 Camden	5	78.4	14	44.3	30.8	52.1	24.6	49.8
16 Carteret	19	32.1	71	24.4	37.9	27.6	21.9	25.0
17 Caswell	11	49.2	36	33.2	13.4	32.3	33.9	29.3
18 Catawba	63	47.9	324	50.7	22	36.0	40.2	57.0
19 Chatham	31	67.5	102	46.3	20.9	33.0	31.8	41.9
20 Cherokee	7	30.7	59	53.4	22.2	25.3	31.1	37.8
21 Chowan	8	55.6	53	74.9	35.1	52.7	61.2	55.3
22 Clay	3	36.4	13	33.0	24.2	35.3	19.6	23.2
23 Cleveland	37	40.3	202	44.9	28.9	27.2	45.1	42.9
24 Columbus	18	34.5	98	38.0	34.9	43.3	41.8	37.1
25 Craven	25	28.1	116	26.7	26.1	27.8	31.2	33.8
26 Cumberland	44	15.0	240	16.3	26.9	30.6	33.1	32.4
27 Currituck	7	40.8	34	41.8	49.5	36.7	61.3	51.6
28 Dare	13	46.2	60	45.2	32.8	30.3	42.8	64.8
29 Davidson	47	33.2	197	28.5	28.5	31.6	30.6	31.5
30 Davie	18	56.0	62	40.5	23.0	35.8	45.8	37.6
31 Duplin	28	63.3	100	46.2	15.4	26.5	40.0	44.5
32 Durham	59	29.4	332	34.0	35.3	36.3	33.2	41.8
33 Edgecombe	28	51.2	110	39.4	30.5	44.9	37.1	41.8
34 Forsyth	107	36.9	461	32.5	25.1	32.7	33.2	33.0
35 Franklin	13	29.3	71	33.4	26.5	22.2	28.9	34.8
36 Gaston	66	36.5	340	37.9	32.1	32.8	34.6	41.6
37 Gates	4	40.0	23	46.6	37.8	38.2	37.4	47.7
38 Graham	3	40.2	18	48.1	16.8	24.2	41.6	39.5
39 Granville	18	40.4	105	49.8	52.3	44.0	56.3	53.8
40 Greene	7	38.2	21	24.3	25.1	26.4	34.7	25.5
41 Guilford	138	35.6	603	32.0	27.1	36.9	33.6	34.0
42 Halifax	24	43.3	108	38.2	34.3	30.0	32.0	35.8
43 Harnett	43	51.4	177	44.7	19.9	34.0	38.2	51.9
44 Haywood	23	44.6	139	55.0	29.4	37.0	36.8	38.0
45 Henderson	52	64.3	258	66.3	25.5	31.3	37.7	39.4
46 Hertford	11	51.0	43	38.9	22.5	32.1	36.2	34.3
47 Hoke	3	10.0	26	18.4	33.2	38.2	47.6	25.4
48 Hyde	4	69.7	12	45.0	47.0	21.1	47.2	36.3
49 Iredell	54	47.6	232	43.5	32.3	37.1	33.2	44.2
50 Jackson	14	47.4	87	59.9	43.6	43.3	51.5	53.6

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 12 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Pneumonia and Influenza

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	42	39.0	168	33.8	21.0	30.7	34.1	38.8
52 Jones	5	54.0	20	42.9	33.6	23.8	33.5	42.7
53 Lee	25	51.3	95	40.4	23.7	25.6	40.9	42.2
54 Lenoir	17	29.0	68	23.1	41.5	29.9	28.6	22.9
55 Lincoln	23	38.9	108	38.0	21.3	29.9	29.8	44.8
56 McDowell	11	27.4	67	34.9	33.7	29.8	34.7	30.5
57 Macon	24	85.3	90	66.9	33.8	25.7	29.0	38.9
58 Madison	15	79.8	63	69.5	39.4	46.6	51.1	51.5
59 Martin	13	50.7	58	45.0	27.7	33.9	37.1	43.0
60 Mecklenburg	186	29.8	689	23.2	28.5	29.2	29.5	33.1
61 Mitchell	5	34.2	35	47.7	45.5	54.4	36.1	33.5
62 Montgomery	4	16.2	26	21.5	34.5	37.3	27.5	23.3
63 Moore	40	56.5	167	49.1	26.0	29.8	38.5	34.3
64 Nash	42	47.7	171	40.0	34.0	41.0	40.6	44.9
65 New Hanover	46	31.0	177	24.8	26.0	26.5	27.7	26.7
66 Northampton	10	48.2	44	42.4	36.6	40.9	42.1	34.4
67 Onslow	25	16.8	109	14.7	31.6	36.6	31.3	37.6
68 Orange	19	17.4	117	21.9	36.8	30.0	27.8	32.9
69 Pamlico	7	57.9	31	51.9	43.7	38.6	45.2	41.1
70 Pasquotank	21	60.4	89	52.4	46.2	34.8	39.8	50.0
71 Pender	6	15.7	52	29.0	23.5	29.9	30.9	29.1
72 Perquimans	9	82.2	29	53.9	22.4	35.7	27.1	43.0
73 Person	8	24.0	61	37.6	18.5	37.7	37.7	34.7
74 Pitt	32	25.3	146	24.2	40.5	37.5	42.3	34.0
75 Polk	9	54.0	45	55.9	33.1	24.4	33.8	27.0
76 Randolph	33	26.6	155	26.1	23.4	26.6	26.2	28.3
77 Richmond	12	26.4	96	42.2	15.8	29.4	32.4	41.3
78 Robeson	35	30.6	167	29.8	32.8	29.4	39.4	37.6
79 Rockingham	34	37.9	167	37.6	30.7	44.0	29.9	33.9
80 Rowan	75	60.1	310	51.3	33.6	35.3	34.9	44.3
81 Rutherford	31	51.6	191	64.4	31.4	42.0	48.6	54.1
82 Sampson	41	76.9	144	55.8	21.1	30.4	38.2	52.3
83 Scotland	14	39.8	52	29.8	29.0	27.9	34.8	35.2
84 Stanly	10	18.0	68	24.9	24.6	28.2	19.0	23.1
85 Stokes	27	62.5	128	61.1	59.6	66.2	58.8	67.9
86 Surry	29	42.7	118	35.8	33.8	32.8	38.4	30.8
87 Swain	5	41.1	36	60.9	41.5	23.5	46.3	50.8
88 Transylvania	12	42.4	64	46.4	19.6	30.7	26.7	31.4
89 Tyrrell	3	77.0	13	68.9	32.7	41.6	37.5	48.2
90 Union	33	30.0	128	25.1	25.2	33.5	45.1	37.2
91 Vance	28	67.2	76	37.4	36.9	43.5	48.1	39.2
92 Wake	82	14.3	429	16.0	28.2	32.0	27.0	26.9
93 Warren	11	58.2	46	50.4	50.9	55.9	32.8	38.1
94 Washington	3	22.9	26	38.5	28.2	47.7	50.0	36.8
95 Watauga	20	48.9	63	31.2	29.5	26.2	31.5	36.7
96 Wayne	25	22.1	120	21.5	30.8	31.3	31.4	27.5
97 Wilkes	38	60.0	117	37.4	30.8	38.0	48.9	36.9
98 Wilson	25	36.0	132	38.6	39.7	44.1	33.6	40.9
99 Yadkin	15	42.1	68	39.5	26.5	50.8	46.5	34.5
100 Yancey	8	48.3	36	44.3	30.3	27.7	35.7	31.4

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Pneumonia and Influenza

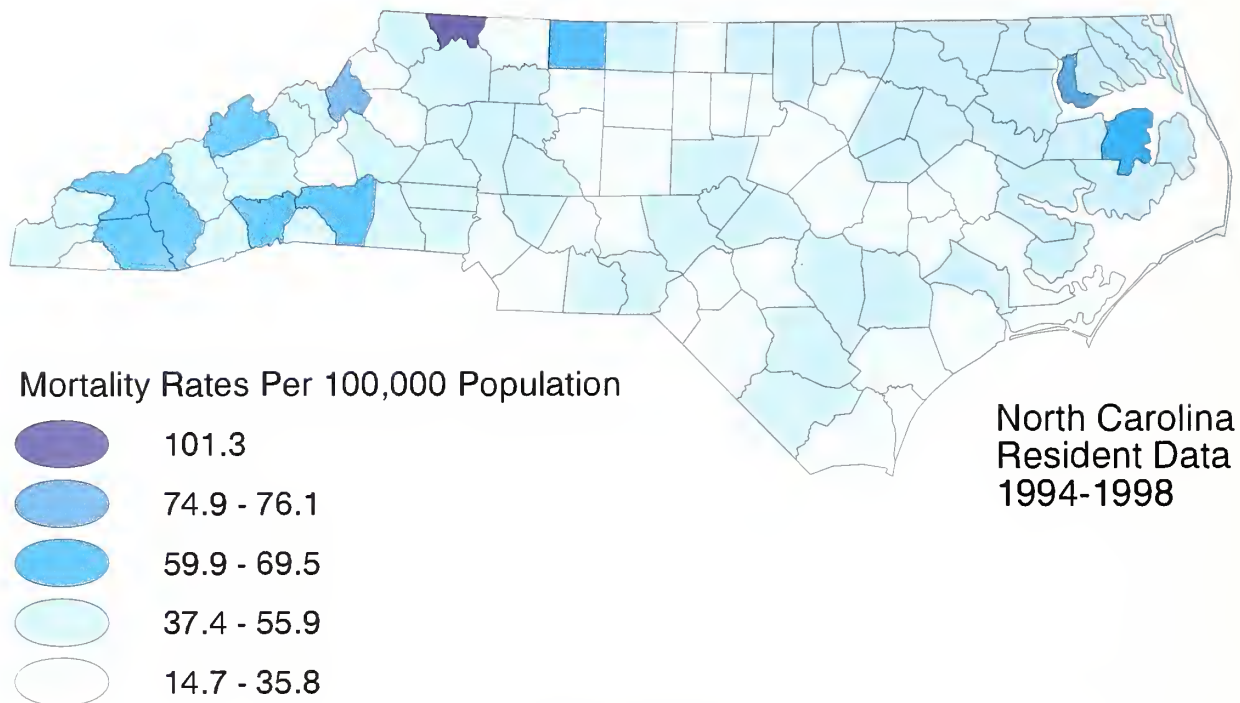


Figure 12.C

Pneumonia and Influenza

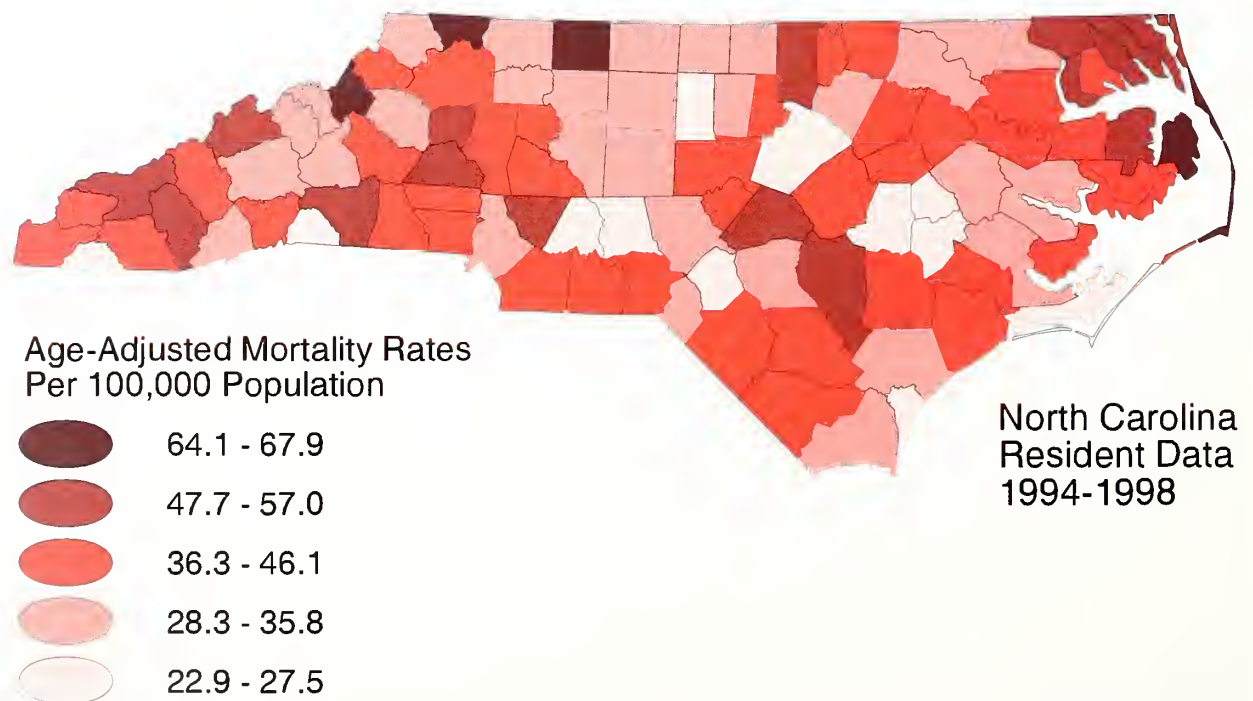


Figure 12.D

Chronic Obstructive Pulmonary Disease & Allied Conditions

Introduction

Chronic obstructive pulmonary disease (COPD) and its allied conditions refer to a group of chronic lung diseases which include conditions such as emphysema, chronic bronchitis, and asthma.

COPD is a chronic debilitating health problem for thousands of North Carolinians. Recent estimates by the American Lung Association reveal that there are approximately 119 cases of COPD per 1,000 North Carolina residents.¹ The incapacitating effects of severe lung problems greatly diminish the quality of life for individuals with COPD. Normal activities of daily life such as getting dressed or walking around the block may leave COPD sufferers out of breath. Many individuals with chronic lung disease eventually require full time oxygen support and recurrent hospitalization.^{2,3} In 1997, COPD was responsible for 27,723 hospitalizations and over \$190 million in total hospital charges in North Carolina. After years of diminished lung capacity, death from COPD is often accompanied by pneumonia, acute respiratory distress, cardiac arrhythmia, or pulmonary embolism.⁴

Differentials and Trends

In 1998 there were 3,200 deaths to COPD in North Carolina, making it the fourth leading cause of death in the state. Approximately five percent of North Carolina resident deaths are attributable to COPD each year. These figures mirror the latest national data where COPD ranked as the fourth leading cause of death in 1997.^{1,2} As shown in Table B, page 12, in 1998 COPD ranked eighth relative to other causes of death in terms of the number of years of life lost — with a total of 14,224 years of life lost for North Carolina residents.

Emphysema accounted for about 15 percent of all COPD mortality, claiming the lives of 493 North Carolinians in 1998. Another five percent (168) of COPD deaths were attributable to asthma. The rest of the COPD deaths were related to other allied lung conditions.

While mortality rates for cancer and heart disease have remained stable or declined over the past 20 years, COPD death rates have increased during the same time period. Whether we examine crude or age-adjusted mortality rates, deaths to COPD have been on the rise in North Carolina since 1979. Five year age-adjusted mortality rates for COPD have increased steadily from a low of 26.2 per 100,000 residents in 1979-1983 to a high of 41.9 deaths per 100,000 in 1994-1998, an increase of 60 percent.

North Carolina resident deaths from COPD are more common among certain demographic groups: the elderly, men, and whites. In 1998, 85 percent (2,727) of all North Carolina COPD deaths occurred among residents ages 65 and over. As shown in Figure 13.B, men were slightly more likely to die from COPD than women. In addition, unlike mortality patterns for most other diseases, COPD death rates are significantly higher for whites than for minorities. As shown in Figure 13.A, from 1979-1998, the age-adjusted mortality rate for whites was consistently higher than the rate for minorities in the state. Higher rates among men and whites are likely related to differential patterns of smoking behavior.⁵

Risk Factors

As with lung cancer, smoking is the most common risk factor associated with chronic obstructive pulmonary disease and allied conditions.^{1,2,5,6} The American Lung Association estimates that between 80 and 90 percent of all COPD cases are attributable to tobacco use.^{1,2}

Another factor believed to be associated with COPD is occupational exposure to chemical fumes and organic dusts. This type of job-related COPD is more common among individuals working in the mining and textile industries.^{6,7}

Genetics may also place some individuals at increased risk of developing particular types of COPD. For example, early-onset emphysema is caused by an inherited deficiency of a protein generated by the liver which helps to maintain proper lung functioning. It is estimated that between 50,000 and 100,000 Americans, mostly of northern European descent, currently have emphysema as a result of this protein deficiency.⁶

In addition, it is known that other factors including viral and bacterial infections, psychological stress, vigorous exercise, and exposure to air pollution, dust, and allergens may exacerbate pre-existing COPD problems and precipitate symptoms of respiratory distress.^{6,7}

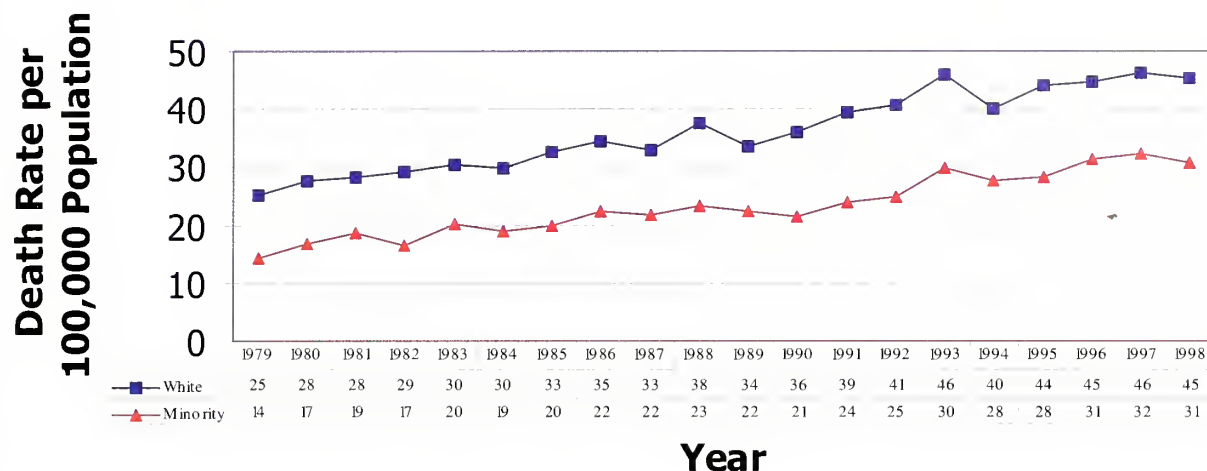
Geographic Patterns

As shown in Figure 13.C, unadjusted mortality rates for COPD are highest in North Carolina's more mountainous, western counties. Western North Carolina counties tend to have an older population and a lower percentage of minorities. Also, some current research suggests that COPD mortality rates tend to increase with altitude and therefore may be more prevalent in mountainous regions.⁴ Although no obvious geographic patterns appear after adjusting for age (Figure 13.D), it appears that North Carolina's rural counties tend to have higher COPD mortality rates than more urban counties.

References

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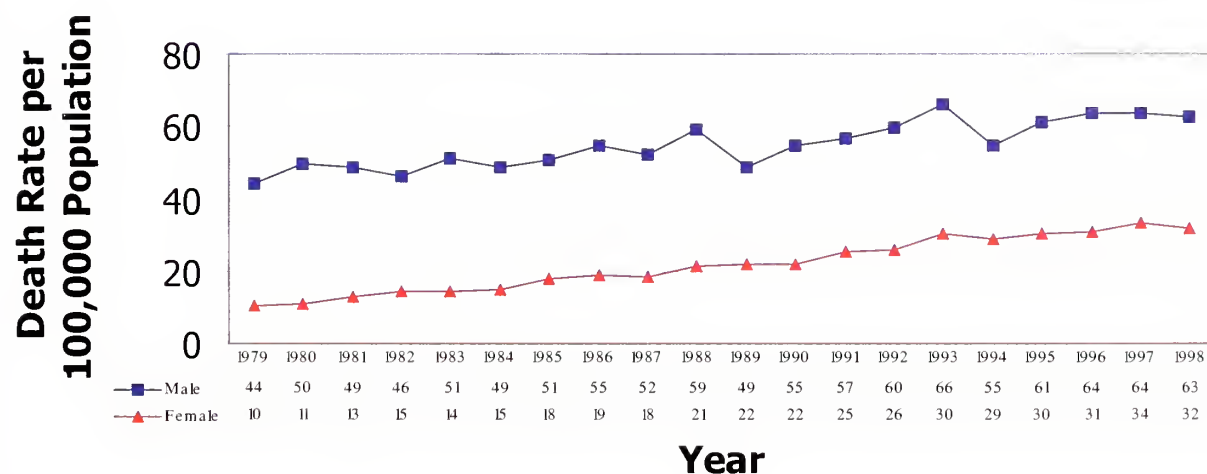
Chronic Obstructive Lung Disease (COPD): North Carolina Resident Age-Adjusted* Death Rates by Race 1979-1998



*U.S. 2000 standard population

Figure 13.A

Chronic Obstructive Lung Disease (COPD): North Carolina Resident Age-Adjusted* Death Rates by Sex 1979-1998



*U.S. 2000 standard population

Figure 13.B

TABLE 13
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Chronic Obstructive Pulmonary Disease (COPD)

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	3,200	42.4	14,822	40.5	26.2	31.3	36.7	41.9
1 Alamance	67	55.1	314	53.4	23.5	36.8	45.9	45.1
2 Alexander	19	59.6	63	41.1	21.9	27.4	25.5	43.5
3 Alleghany	8	81.2	32	66.2	30.0	31.1	40.5	43.7
4 Anson	12	50.0	45	37.7	19.4	12.7	24.0	30.8
5 Ashe	19	80.2	87	74.6	28.9	42.1	53.5	52.0
6 Avery	17	111.0	57	74.7	47.3	55.6	50.7	60.5
7 Beaufort	22	50.5	97	44.8	24.4	39.3	41.6	37.8
8 Bertie	10	49.9	47	46.1	13.3	26.2	32.3	40.8
9 Bladen	16	52.0	74	49.2	26.0	28.6	38.7	42.2
10 Brunswick	38	56.5	153	48.6	23.9	26.1	36.1	45.0
11 Buncombe	135	69.8	588	61.9	27.9	36.6	37.9	48.6
12 Burke	49	58.3	199	48.4	26.7	32.9	41.8	44.3
13 Cabarrus	49	40.6	224	39.4	25.2	30.3	33.3	39.3
14 Caldwell	37	49.1	161	43.4	26.2	30.9	39.5	41.9
15 Camden	4	62.7	27	85.5	16.8	46.7	46.9	78.6
16 Carteret	32	54.0	154	52.9	23.8	34.0	37.5	48.1
17 Caswell	12	53.6	57	52.5	23.3	34.0	31.2	44.1
18 Catawba	59	44.9	263	41.1	23.8	26.8	36.7	41.4
19 Chatham	22	47.9	82	37.2	23.9	22.9	29.6	31.8
20 Cherokee	14	61.5	71	64.2	17.1	30.1	39.3	43.0
21 Chowan	3	20.9	27	38.1	20.1	28.4	52.7	28.3
22 Clay	1	12.1	29	73.5	30.8	35.0	27.8	46.8
23 Cleveland	41	44.7	164	36.5	18.9	30.5	32.6	33.4
24 Columbus	13	24.9	105	40.7	19.1	28.0	29.1	37.2
25 Craven	35	39.3	167	38.4	26.2	39.5	41.0	42.2
26 Cumberland	91	31.1	444	30.2	27.4	37.3	45.0	54.0
27 Currituck	4	23.3	38	46.7	21.6	30.9	50.2	48.3
28 Dare	14	49.8	53	40.0	15.7	23.3	33.8	47.8
29 Davidson	66	46.7	304	43.9	23.6	32.6	36.2	44.1
30 Davie	18	56.0	66	43.1	32.7	32.5	32.7	37.9
31 Duplin	24	54.2	93	42.9	27.9	37.7	38.5	39.7
32 Durham	65	32.4	302	30.9	26.9	22.8	34.2	38.5
33 Edgecombe	31	56.7	132	47.3	31.0	27.9	30.9	48.8
34 Forsyth	124	42.8	583	41.1	29.5	34.4	40.9	41.3
35 Franklin	21	47.3	71	33.4	21.9	21.3	29.1	34.1
36 Gaston	110	60.8	436	48.6	22.2	29.7	39.3	49.9
37 Gates	7	70.0	25	50.7	24.0	25.2	44.1	46.0
38 Graham	5	67.0	28	74.9	18.6	45.2	40.3	57.0
39 Granville	20	44.9	83	39.4	25.1	32.4	29.1	40.9
40 Greene	10	54.5	33	38.2	21.4	34.5	26.0	37.9
41 Guilford	156	40.2	803	42.6	26.3	31.1	40.1	43.8
42 Halifax	28	50.5	142	50.3	26.4	33.6	44.6	45.9
43 Harnett	34	40.7	179	45.2	28.7	36.5	34.6	49.8
44 Haywood	20	38.7	166	65.7	31.4	41.3	42.7	43.4
45 Henderson	77	95.2	289	74.3	24.1	33.1	41.5	43.9
46 Hertford	12	55.7	47	42.5	24.8	26.4	36.1	36.3
47 Hoke	8	26.6	44	31.2	27.4	36.3	32.0	43.5
48 Hyde	3	52.3	15	56.2	13.1	36.9	36.0	45.0
49 Iredell	42	37.0	234	43.9	25.0	23.6	34.8	42.1
50 Jackson	22	74.4	85	58.6	22.9	31.5	33.4	50.4

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 13 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Chronic Obstructive Pulmonary Disease (COPD)

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	37	34.3	177	35.6	32.4	30.5	28.2	36.6
52 Jones	3	32.4	34	73.0	27.2	30.7	28.8	66.7
53 Lee	18	36.9	78	33.1	40.8	34.7	33.7	31.8
54 Lenoir	26	44.4	140	47.5	30.3	25.5	41.2	43.6
55 Lincoln	31	52.5	115	40.5	20.0	23.0	27.0	42.6
56 McDowell	15	37.4	101	52.7	35.6	42.5	39.5	44.1
57 Macon	13	46.2	86	63.9	19.3	28.8	28.0	36.9
58 Madison	17	90.5	70	77.2	28.0	20.4	37.2	58.2
59 Martin	9	35.1	49	38.0	23.4	29.8	30.6	33.6
60 Mecklenburg	176	28.2	854	28.8	27.5	30.0	35.8	39.3
61 Mitchell	14	95.7	56	76.4	43.1	49.2	46.1	52.5
62 Montgomery	9	36.4	49	40.5	24.8	39.1	38.0	39.9
63 Moore	35	49.4	180	52.9	30.8	35.2	27.9	34.9
64 Nash	38	43.1	163	38.1	34.3	38.0	42.9	39.5
65 New Hanover	73	49.2	333	46.7	28.6	32.4	35.2	46.6
66 Northampton	14	67.5	57	54.9	22.5	20.9	34.7	44.0
67 Onslow	46	30.9	182	24.5	25.4	44.6	46.0	58.7
68 Orange	20	18.3	106	19.9	26.3	24.7	30.1	28.7
69 Pamlico	6	49.6	30	50.2	18.9	31.0	37.5	36.6
70 Pasquotank	18	51.8	92	54.2	25.4	18.6	40.6	50.7
71 Pender	19	49.9	93	51.8	26.5	37.2	49.4	46.9
72 Perquimans	3	27.4	22	40.9	11.4	24.8	33.1	28.4
73 Person	12	36.0	63	38.8	17.9	29.8	35.7	34.7
74 Pitt	39	30.8	209	34.6	27.2	42.1	35.8	45.4
75 Polk	17	102.0	65	80.8	32.8	27.4	24.8	42.4
76 Randolph	58	46.7	237	40.0	22.8	22.7	37.3	40.0
77 Richmond	22	48.3	120	52.8	30.7	37.5	37.3	47.7
78 Robeson	38	33.2	184	32.9	24.3	35.9	32.3	38.7
79 Rockingham	61	68.0	263	59.2	26.7	33.3	40.8	51.3
80 Rowan	71	56.9	293	48.5	20.2	24.9	33.8	41.6
81 Rutherford	29	48.3	149	50.3	25.6	32.5	37.9	41.4
82 Sampson	26	48.8	121	46.9	23.9	32.9	38.3	42.4
83 Scotland	13	36.9	66	37.8	22.6	30.6	35.9	42.9
84 Stanly	28	50.4	129	47.3	22.7	20.7	24.4	42.1
85 Stokes	14	32.4	64	30.6	34.0	31.1	37.2	32.1
86 Surry	42	61.8	198	60.0	35.4	35.6	41.7	49.8
87 Swain	7	57.5	22	37.2	29.3	37.9	32.7	30.2
88 Transylvania	16	56.5	72	52.2	23.9	26.1	33.7	33.0
89 Tyrrell	2	51.3	16	84.8	35.6	23.2	55.1	62.9
90 Union	26	23.6	115	22.5	21.8	20.0	24.1	28.9
91 Vance	12	28.8	92	45.3	32.2	33.9	38.2	46.0
92 Wake	136	23.7	594	22.1	27.2	31.3	31.7	35.5
93 Warren	7	37.0	37	40.6	22.0	22.4	33.2	29.2
94 Washington	7	53.4	27	40.0	16.1	40.9	32.6	35.3
95 Watauga	16	39.1	57	28.3	24.9	25.0	31.2	31.7
96 Wayne	33	29.1	200	35.8	31.5	34.5	41.3	43.1
97 Wilkes	33	52.1	129	41.3	25.6	34.8	43.6	37.2
98 Wilson	27	38.9	133	38.9	26.4	35.0	33.8	38.2
99 Yadkin	17	47.7	75	43.6	23.1	27.8	38.4	35.9
100 Yancey	5	30.2	43	52.9	29.2	24.6	39.9	37.5

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Chronic Obstructive Pulmonary Diseases

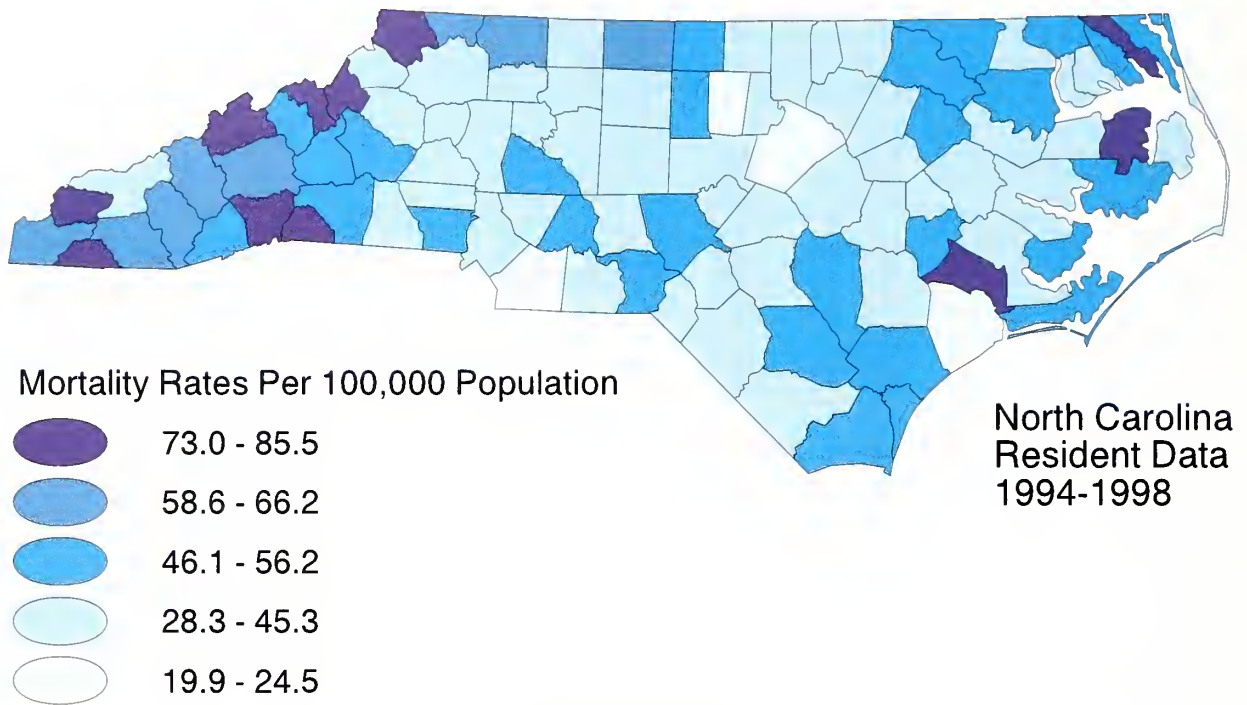


Figure 13.C

Chronic Obstructive Pulmonary Diseases

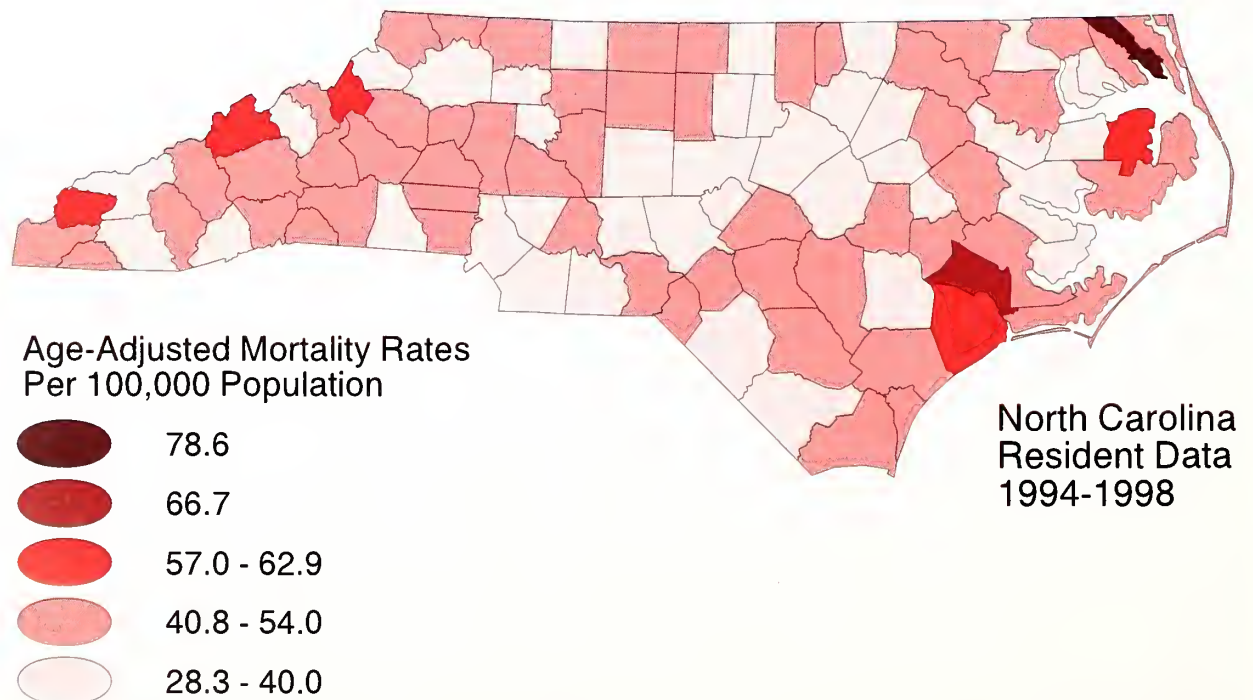


Figure 13.D

Chronic Liver Disease and Cirrhosis

Introduction

Nationally, the tenth leading cause of death in 1997 was chronic liver disease.¹ Chronic liver diseases include viral hepatitis and cirrhosis. Cirrhosis is a degenerative liver disease that may be caused by infections such as hepatitis or anything else that causes liver injury. Viruses, many poisons, and reactions to some drugs can cause liver damage, but cirrhosis is most commonly caused by alcoholism.² In North Carolina, 699 people died of these diseases in 1998. Of these, 539 were white and 160 were minority. The 1998 unadjusted death rate was 9.3 per 100,000 population.

Differentials and Trends

The trends for rates of death for the past 20 years indicate declining mortality risk from these diseases. Age-adjusted death rates for 1979-83, 1984-88, 1989-93, and 1994-98 were 12.5, 10.9, 10.9, and 9.5. The rate of minority deaths showed a stronger decline during the past decade, from 19.3 in 1988 to 10.8 in 1998. The rate of minority deaths was nearly twice that of whites in 1979, 23.4 versus 12.0. Age-adjusted death rates have declined for all groups during the 20-year period. The greatest drop in the minority death rate occurred between 1988 and 1998. During 1994-1998, age-adjusted rates were 19.0 for minority males, 12.3 for white males, 7.7 for minority females and 5.4 for white females. In 1998, the rates were much more similar for minorities (10.8) and whites (8.7) than in previous years. The rate of death for females is still about half that of males.

Risk Factors

Although mortality rates for chronic liver diseases and cirrhosis have declined in recent years, liver dysfunction is still a leading cause of death. It kills approximately 25,000 Americans each year. While these diseases are not entirely attributable to alcohol abuse, alcoholism is the most common cause. Some chronic liver conditions are related to inherited conditions, such as cystic fibrosis, Wilson's disease, hemochromatosis, and glycogen storage diseases or to chronic viral hepatitis.³ Declining deaths from cirrhosis in several Western countries have been linked to decreases in alcohol consumption⁴ and to increased treatments for alcoholism, but some studies found that geographic variability exists due to lag times for different populations.^{5,6,7}

Geographic Patterns

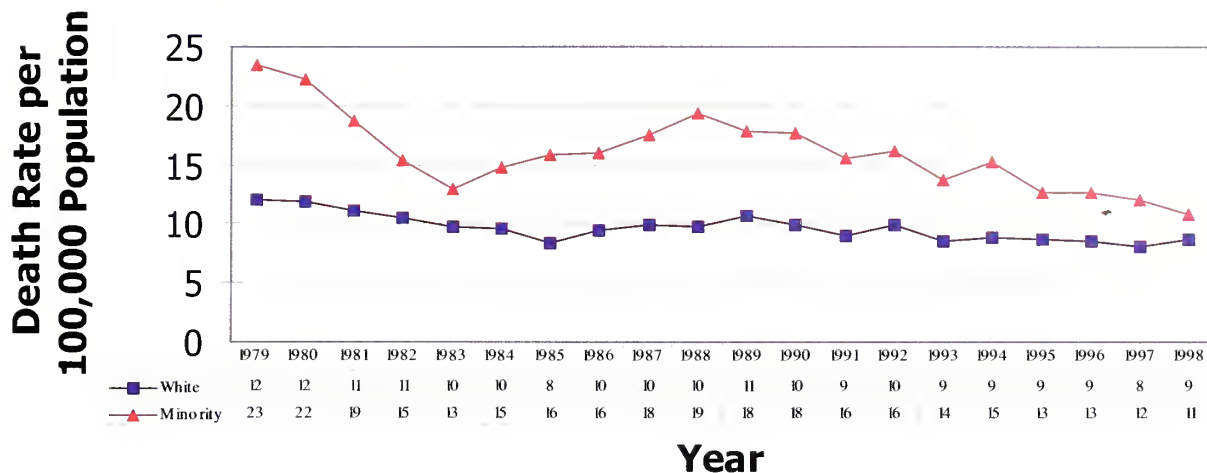
Rural counties tend to have higher unadjusted and age-adjusted mortality rates, particularly in the northeastern part of the state. In Halifax and a few surrounding counties, the rates are particularly elevated.

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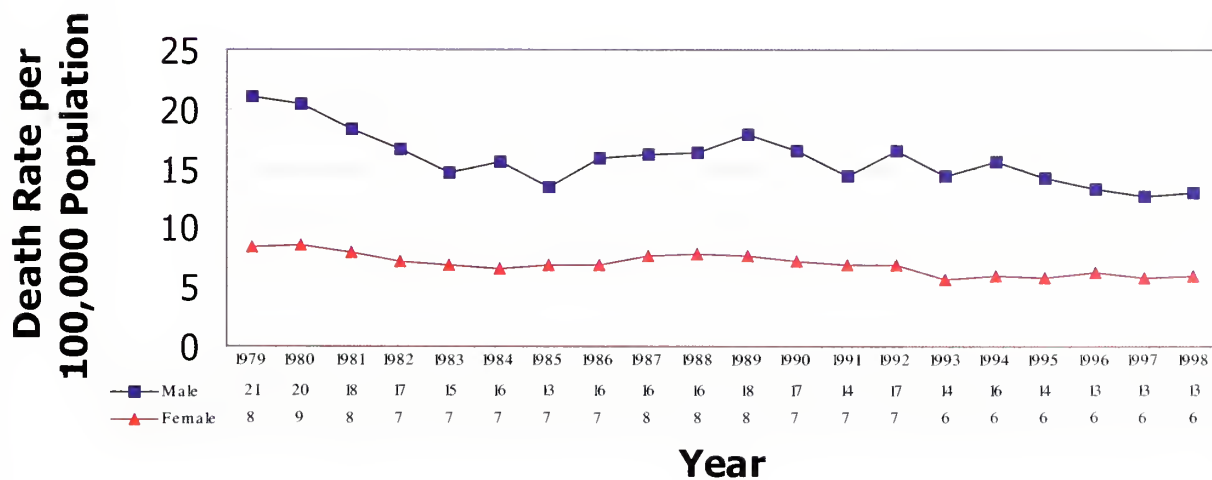
Chronic Liver Disease and Cirrhosis: North Carolina Resident Age-Adjusted* Death Rates by Race 1979-1998



*U.S. 2000 standard population

Figure 14.A

Chronic Liver Disease and Cirrhosis: North Carolina Resident Age-Adjusted* Death Rates by Sex 1979-1998



*U.S. 2000 standard population

Figure 14.B

TABLE 14
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Chronic Liver Disease and Cirrhosis

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	699	9.3	3,429	9.4	12.5	10.9	10.9	9.5
1 Alamance	12	9.9	61	10.4	7.0	9.7	9.1	9.4
2 Alexander	2	6.3	16	10.4	13.1	6.9	8.4	10.0
3 Alleghany	2	20.3	7	14.5	11.6	6.2	7.4	10.8
4 Anson	1	4.2	8	6.7	16.3	10.1	16.3	6.6
5 Ashe	3	12.7	11	9.4	3.3	4.9	7.2	7.4
6 Avery	3	19.6	10	13.1	8.1	17.0	19.8	11.7
7 Beaufort	6	13.8	21	9.7	14.8	15.7	13.8	8.5
8 Bertie	5	25.0	16	15.7	16.2	8.2	7.5	15.3
9 Bladen	0	0.0	16	10.6	6.0	6.8	13.3	9.8
10 Brunswick	11	16.3	48	15.3	8.1	14.7	11.7	12.6
11 Buncombe	22	11.4	120	12.6	12.7	9.3	12.2	11.4
12 Burke	9	10.7	40	9.7	8.8	11.7	10.5	9.1
13 Cabarrus	10	8.3	36	6.3	9.6	8.9	8.0	6.2
14 Caldwell	8	10.6	36	9.7	14.8	7.6	8.0	9.1
15 Camden	1	15.7	3	9.5	12.8	4.1	3.5	8.0
16 Carteret	5	8.4	28	9.6	13.2	12.4	13.1	8.2
17 Caswell	0	0.0	12	11.1	6.5	10.2	12.7	10.2
18 Catawba	8	6.1	54	8.4	16.1	9.3	10.4	8.2
19 Chatham	1	2.2	14	6.4	9.9	3.4	9.6	5.7
20 Cherokee	4	17.6	11	10.0	10.7	16.0	8.2	9.0
21 Chowan	2	13.9	10	14.1	8.4	6.8	15.9	12.5
22 Clay	0	0.0	4	10.1	8.2	13.5	3.7	6.7
23 Cleveland	10	10.9	60	13.3	9.9	14.4	14.2	12.5
24 Columbus	8	15.3	33	12.8	9.3	8.5	12.0	12.3
25 Craven	10	11.2	44	10.1	15.1	10.4	11.6	11.0
26 Cumberland	19	6.5	101	6.9	13.7	15.3	11.5	9.4
27 Currituck	2	11.7	12	14.8	9.8	11.7	8.0	13.3
28 Dare	2	7.1	8	6.0	8.9	10.1	9.6	6.4
29 Davidson	20	14.1	62	9.0	8.9	8.2	8.1	8.6
30 Davie	1	3.1	14	9.1	11.1	5.8	6.1	8.3
31 Duplin	3	6.8	22	10.2	12.7	10.5	10.0	9.5
32 Durham	21	10.5	82	8.4	12.1	12.0	9.1	9.7
33 Edgecombe	7	12.8	39	14.0	12.3	18.1	17.5	14.7
34 Forsyth	29	10.0	126	8.9	15.2	14.2	11.6	8.9
35 Franklin	8	18.0	23	10.8	15.0	11.2	15.2	10.8
36 Gaston	21	11.6	129	14.4	13.6	14.7	12.9	14.5
37 Gates	1	10.0	2	4.1	3.5	13.3	1.9	3.9
38 Graham	1	13.4	2	5.3	10.9	7.2	9.6	4.7
39 Granville	4	9.0	20	9.5	13.0	6.6	10.4	9.3
40 Greene	1	5.5	9	10.4	7.9	11.8	2.7	9.8
41 Guilford	33	8.5	179	9.5	13.0	10.0	10.9	9.5
42 Halifax	11	19.8	52	18.4	21.1	19.0	16.4	18.1
43 Harnett	8	9.6	41	10.3	17.4	8.5	7.8	11.1
44 Haywood	5	9.7	33	13.1	10.5	10.1	11.4	10.1
45 Henderson	10	12.4	39	10.0	13.0	8.9	10.3	7.9
46 Hertford	3	13.9	17	15.4	15.4	16.0	20.1	15.1
47 Hoke	5	16.6	11	7.8	15.0	8.4	16.4	9.0
48 Hyde	0	0.0	3	11.2	2.9	27.9	5.9	9.0
49 Iredell	9	7.9	46	8.6	12.7	9.3	11.0	8.2
50 Jackson	3	10.1	15	10.3	12.9	11.8	15.7	9.8

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 14 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Chronic Liver Disease and Cirrhosis

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	7	6.5	40	8.0	10.0	11.5	13.0	7.9
52 Jones	3	32.4	6	12.9	8.8	12.7	9.2	11.7
53 Lee	5	10.3	22	9.3	12.6	14.6	13.2	9.3
54 Lenoir	5	8.5	38	12.9	14.2	13.6	12.4	12.2
55 Lincoln	3	5.1	31	10.9	9.7	8.7	8.6	11.0
56 McDowell	6	15.0	26	13.6	6.3	11.4	12.5	11.7
57 Macon	0	0.0	9	6.7	5.0	6.3	11.1	4.7
58 Madison	2	10.6	14	15.4	7.1	4.7	12.0	13.3
59 Martin	4	15.6	13	10.1	11.3	11.7	14.5	9.3
60 Mecklenburg	37	5.9	219	7.4	15.8	10.2	10.9	8.5
61 Mitchell	0	0.0	3	4.1	6.5	13.2	14.6	3.3
62 Montgomery	3	12.1	8	6.6	12.4	8.7	5.9	6.2
63 Moore	7	9.9	31	9.1	18.1	17.6	11.5	7.1
64 Nash	12	13.6	50	11.7	15.0	12.9	16.3	11.7
65 New Hanover	18	12.1	76	10.7	16.2	13.2	14.0	10.3
66 Northampton	1	4.8	13	12.5	7.8	13.7	13.7	10.5
67 Onslow	11	7.4	42	5.7	13.3	11.4	14.5	11.8
68 Orange	13	11.9	34	6.4	8.5	8.8	3.6	8.3
69 Pamlico	1	8.3	6	10.0	14.7	10.7	8.5	7.9
70 Pasquotank	4	11.5	14	8.2	8.9	5.4	8.7	8.4
71 Pender	7	18.4	20	11.1	17.0	12.1	12.1	10.6
72 Perquimans	1	9.1	6	11.2	9.6	16.5	12.2	7.8
73 Person	4	12.0	24	14.8	14.9	8.4	7.3	13.8
74 Pitt	15	11.8	61	10.1	10.7	11.7	14.9	12.3
75 Polk	2	12.0	9	11.2	14.3	5.0	14.1	9.3
76 Randolph	7	5.6	34	5.7	8.3	8.2	7.8	5.7
77 Richmond	5	11.0	23	10.1	10.5	14.9	13.4	9.8
78 Robeson	14	12.2	72	12.9	11.8	10.2	13.2	14.3
79 Rockingham	4	4.5	47	10.6	13.8	11.6	13.4	9.5
80 Rowan	15	12.0	57	9.4	13.2	10.0	8.9	8.6
81 Rutherford	4	6.7	38	12.8	7.7	9.5	10.2	11.4
82 Sampson	9	16.9	39	15.1	11.5	10.1	12.0	13.9
83 Scotland	3	8.5	24	13.7	14.4	16.3	10.5	14.7
84 Stanly	2	3.6	17	6.2	8.9	7.3	9.5	5.6
85 Stokes	2	4.6	10	4.8	5.7	11.3	10.5	5.0
86 Surry	6	8.8	31	9.4	9.7	11.3	9.8	8.3
87 Swain	1	8.2	7	11.8	20.8	22.0	16.2	10.0
88 Transylvania	2	7.1	13	9.4	11.2	8.3	14.3	7.9
89 Tyrrell	2	51.3	3	15.9	10.1	27.3	13.1	16.5
90 Union	8	7.3	31	6.1	7.1	6.9	8.5	6.7
91 Vance	6	14.4	29	14.3	19.2	13.2	15.5	15.1
92 Wake	29	5.0	148	5.5	13.3	8.4	7.5	7.2
93 Warren	2	10.6	14	15.3	15.2	15.1	8.0	13.7
94 Washington	3	22.9	5	7.4	17.5	7.3	5.3	6.7
95 Watauga	2	4.9	5	2.5	11.7	5.1	7.2	2.9
96 Wayne	13	11.5	67	12.0	17.8	12.6	13.2	12.7
97 Wilkes	6	9.5	24	7.7	6.9	8.9	8.0	7.3
98 Wilson	9	13.0	52	15.2	18.1	13.5	14.2	14.9
99 Yadkin	3	8.4	10	5.8	11.4	10.2	5.4	5.1
100 Yancey	1	6.0	8	9.8	8.1	7.6	6.8	7.4

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Chronic Liver Disease and Cirrhosis

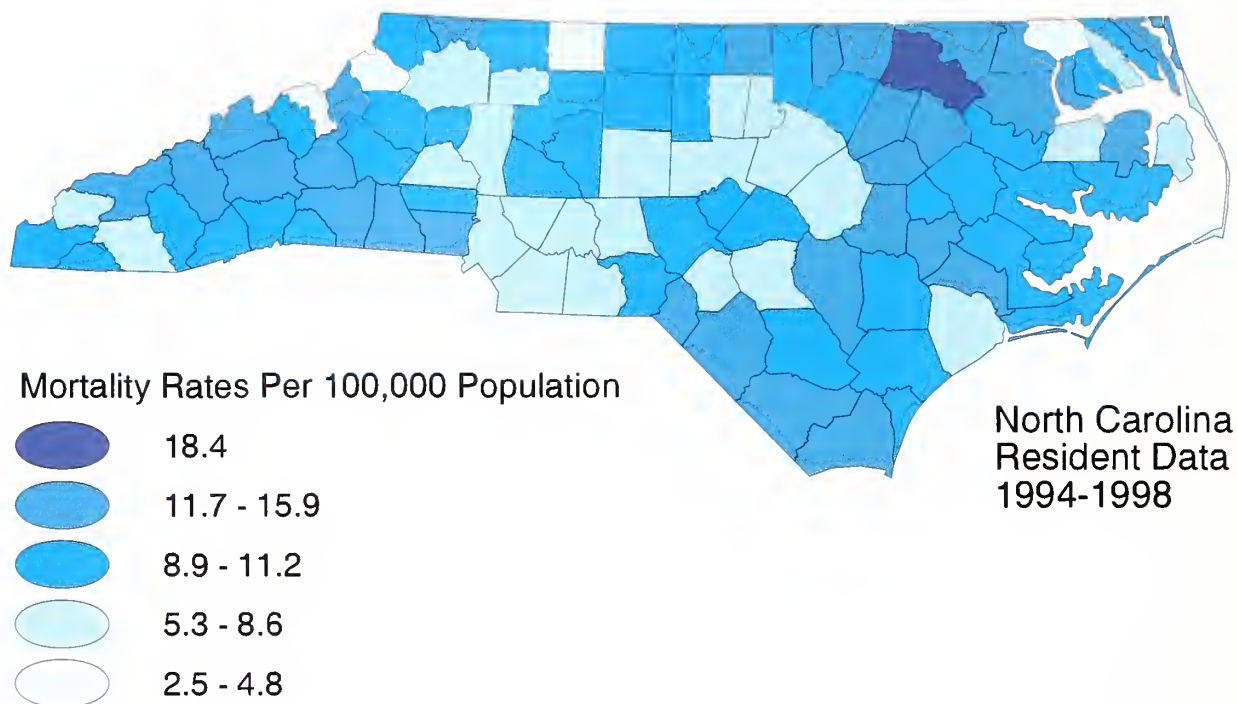


Figure 14.C

Chronic Liver Disease and Cirrhosis

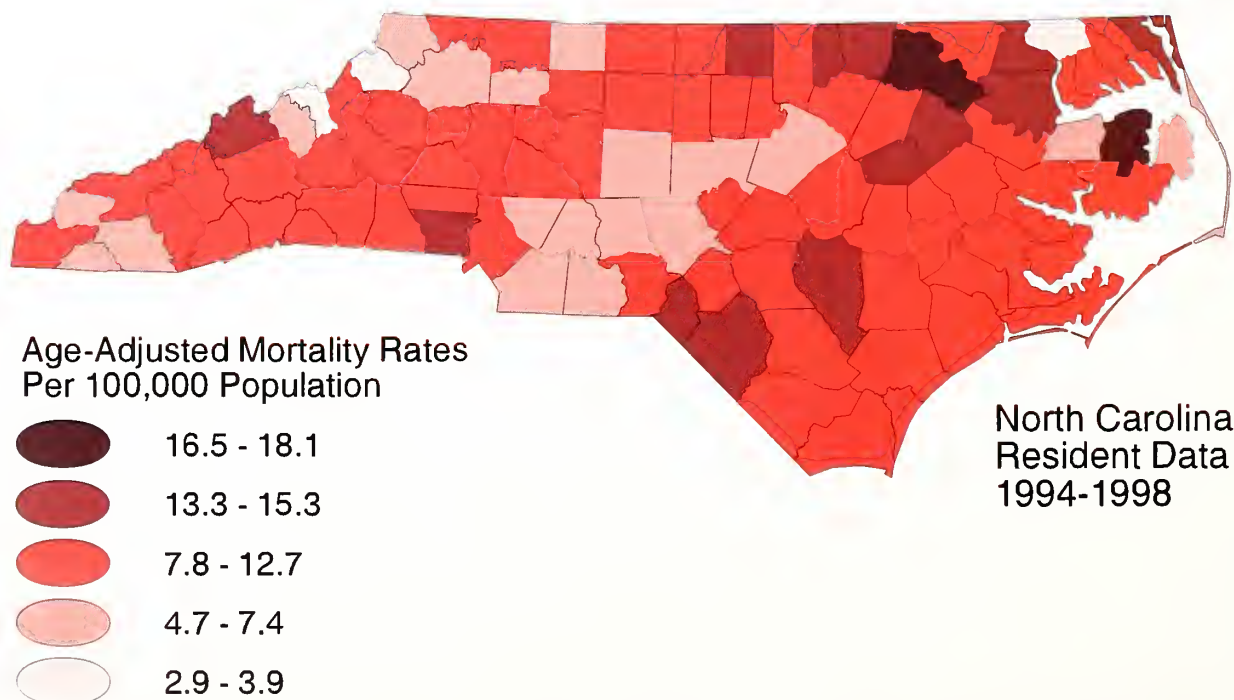


Figure 14.D

Nephritis, Nephrosis, and Nephrotic Syndrome

Introduction

Nephritis, nephrosis, and nephrotic syndrome are diseases associated with the kidney. Nephritis is kidney failure regardless of the causal agent.¹ It manifests itself as inflammation of the kidney. Nephrosis and nephrotic syndrome present themselves as proteinuria, a condition in which excessive amounts of protein are excreted in the urine.² Clinical considerations include the underlying renal pathology, systemic hypertension, the magnitude and duration of proteinuria, and the degree of functional renal deterioration.³

Differentials and Trends

There were 702 deaths to North Carolina residents in 1998 attributed to nephritis/nephrosis. This resulted in a nephritis and nephrosis mortality rate of 9.3 deaths per 100,000 population. The age-adjusted death rate in North Carolina shows a decline from 1979 to 1988, followed by an increase. The 1979 rate of 10.0 declined to 8.3 in 1988, but has risen since then to a rate of 9.7 in 1998.

Of the 702 deaths to nephritis/nephrosis in North Carolina, the majority (87%) were reported for individuals ages 65 and over. Nephritis was the tenth leading cause of death among individuals in this age group. Looking at the differences by sex, we find that nephritis/nephrosis ranked as the tenth leading cause of death among women. Overall, nephritis/nephrosis was not one of the ten leading causes of death in North Carolina. Nephritis/nephrosis ranked as the ninth leading cause of death overall in 1997 for the United States.⁴

Risk Factors

While nephritis/nephrosis can kill at any age, perhaps the greatest risk factor for developing the disease is increased age. The elderly are at greater risk of nephritis/nephrosis mortality. As stated earlier, the vast majority of deaths from nephritis/nephrosis in North Carolina in 1998 were in persons ages 65 and older. In addition, individuals with other chronic diseases such as heart disease, hypertension, and diabetes are also at greater risk for nephritis/nephrosis mortality. Efforts aimed at controlling high blood pressure and diabetes coupled with proper nutrition would likely result in a reduction in nephritis and nephrosis deaths.

Geographic Patterns

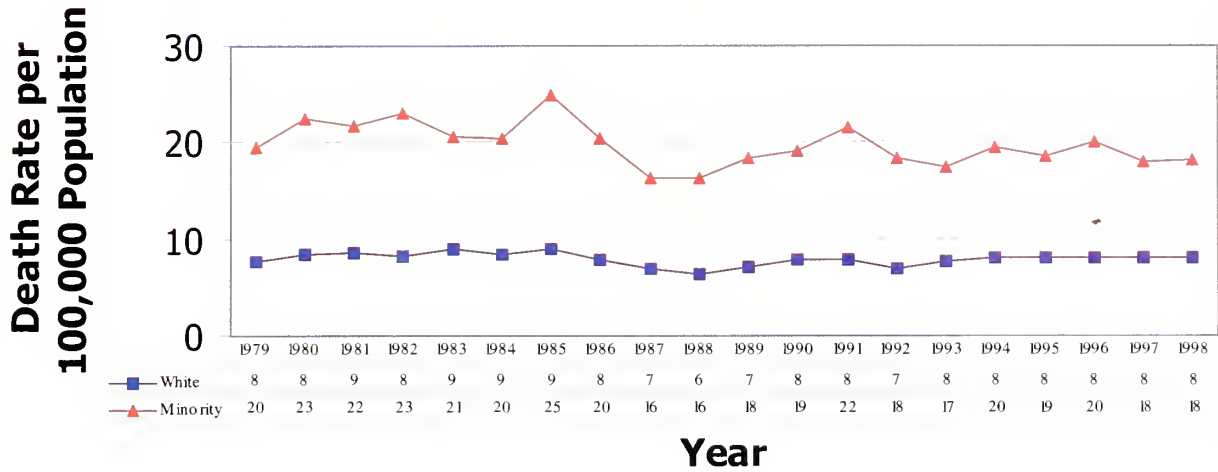
The geographic distribution of mortality associated with nephritis/nephrosis is presented in Figures 15.C and 15.D. In general, the unadjusted and age-adjusted rates both show the same spatial distribution. It appears that nephritis mortality is relatively evenly distributed across the state.

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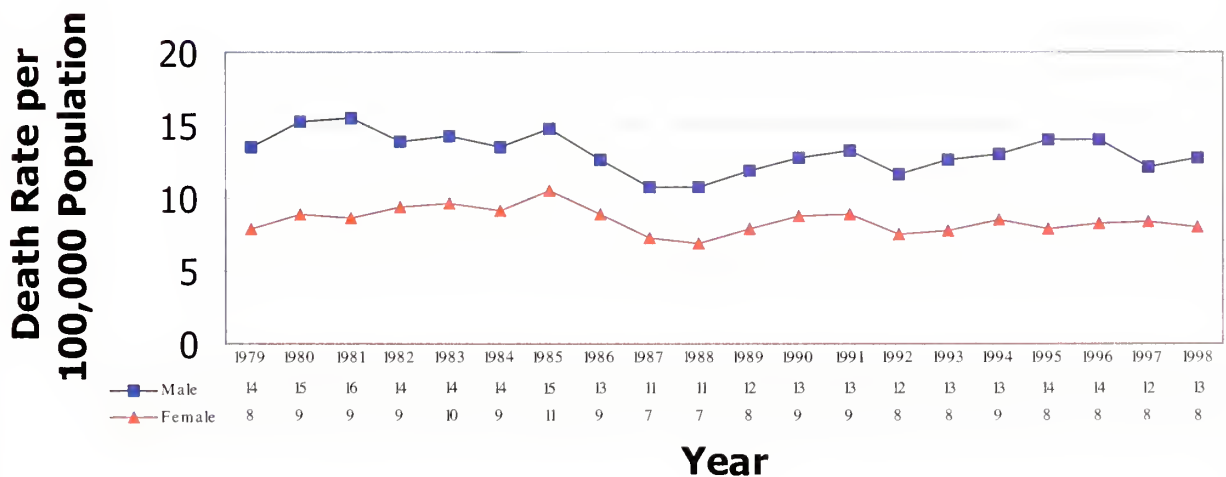
Nephritis and Nephrosis: North Carolina Resident Age-Adjusted* Death Rates by Race 1979-1998



*U.S. 2000 standard population

Figure 15.A

Nephritis and Nephrosis: North Carolina Resident Age-Adjusted* Death Rates by Sex 1979-1998



*U.S. 2000 standard population

Figure 15.B

TABLE 15
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Nephritis and Nephrosis

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	702	9.3	3,412	9.3	10.9	9.9	9.6	10.0
1 Alamance	13	10.7	54	9.2	7.2	10.6	10.2	8.2
2 Alexander	2	6.3	16	10.4	17.6	4.3	11.7	11.5
3 Alleghany	1	10.1	4	8.3	18.0	8.6	11.8	5.5
4 Anson	4	16.7	25	20.9	16.9	10.9	7.9	17.5
5 Ashe	1	4.2	13	11.1	6.3	11.3	6.8	8.1
6 Avery	3	19.6	11	14.4	7.3	11.6	11.9	12.2
7 Beaufort	3	6.9	20	9.2	9.1	11.5	9.9	8.0
8 Bertie	4	20.0	17	16.7	20.6	18.5	16.1	15.9
9 Bladen	4	13.0	26	17.3	25.7	17.3	15.5	15.8
10 Brunswick	7	10.4	28	8.9	6.7	5.8	10.8	9.5
11 Buncombe	28	14.5	125	13.2	6.3	5.7	6.7	10.4
12 Burke	13	15.5	39	9.5	7.8	7.7	10.8	9.1
13 Cabarrus	11	9.1	61	10.7	11.2	7.1	10.0	11.2
14 Caldwell	8	10.6	36	9.7	13.5	7.0	7.2	9.9
15 Camden	0	0.0	2	6.3	16.1	9.4	8.4	7.3
16 Carteret	3	5.1	23	7.9	11.5	7.1	6.2	7.6
17 Caswell	3	13.4	11	10.1	11.4	9.7	11.3	8.9
18 Catawba	22	16.7	93	14.5	7.7	10.4	13.3	15.
19 Chatham	5	10.9	15	6.8	9.3	12.4	9.3	6.1
20 Cherokee	4	17.6	19	17.2	4.8	4.9	10.2	11.8
21 Chowan	3	20.9	10	14.1	16.7	6.3	11.9	10.0
22 Clay	2	24.3	5	12.7	7.5	3.8	4.1	8.0
23 Cleveland	4	4.4	33	7.3	9.1	8.5	11.5	6.8
24 Columbus	8	15.3	38	14.7	14.7	19.7	14.9	14.0
25 Craven	4	4.5	32	7.4	16.5	12.0	9.5	8.3
26 Cumberland	16	5.5	83	5.7	9.2	10.6	10.8	9.9
27 Currituck	0	0.0	3	3.7	4.4	5.2	6.0	4.6
28 Dare	2	7.1	8	6.0	13.8	11.1	7.1	7.9
29 Davidson	9	6.4	76	11.0	13.1	10.7	10.5	11.5
30 Davie	6	18.7	23	15.0	11.9	10.6	11.3	13.3
31 Duplin	5	11.3	34	15.7	9.6	19.8	11.4	14.8
32 Durham	17	8.5	119	12.2	14.5	11.9	13.1	15.1
33 Edgecombe	5	9.1	34	12.2	9.8	10.6	13.0	12.9
34 Forsyth	34	11.7	156	11.0	9.7	8.9	10.6	11.2
35 Franklin	0	0.0	20	9.4	18.5	10.3	10.7	9.8
36 Gaston	22	12.2	98	10.9	12.1	9.8	8.9	11.8
37 Gates	1	10.0	10	20.3	12.6	9.1	12.5	19.4
38 Graham	1	13.4	2	5.3	4.7	13.7	18.9	4.4
39 Granville	4	9.0	27	12.8	19.3	12.5	8.2	13.3
40 Greene	2	10.9	5	5.8	8.3	11.9	11.8	5.9
41 Guilford	32	8.2	127	6.7	7.9	7.6	8.7	7.0
42 Halifax	8	14.4	35	12.4	11.5	15.7	9.4	11.6
43 Harnett	7	8.4	26	6.6	12.7	12.1	12.8	7.5
44 Haywood	3	5.8	26	10.3	8.8	6.7	6.2	6.8
45 Henderson	12	14.8	46	11.8	5.2	6.7	7.7	7.1
46 Hertford	2	9.3	17	15.4	15.2	9.8	13.4	13.2
47 Hoke	3	10.0	13	9.2	17.9	13.7	11.7	12.7
48 Hyde	0	0.0	2	7.5	20.5	9.7	18.6	6.7
49 Iredell	11	9.7	51	9.6	9.4	10.2	8.7	9.2
50 Jackson	2	6.8	11	7.6	7.9	11.2	12.1	6.6

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 15 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Nephritis and Nephrosis

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	14	13.0	55	11.1	13.2	9.2	10.7	12.5
52 Jones	2	21.6	12	25.8	17.3	10.4	10.3	26.3
53 Lee	1	2.1	24	10.2	12.4	22.0	11.3	11.2
54 Lenoir	16	27.3	66	22.4	11.0	17.0	16.6	21.5
55 Lincoln	4	6.8	27	9.5	12.8	8.7	11.8	10.8
56 McDowell	7	17.5	19	9.9	12.4	10.1	11.2	8.7
57 Macon	3	10.7	11	8.2	11.4	6.4	4.2	4.7
58 Madison	1	5.3	4	4.4	9.2	7.6	10.1	3.3
59 Martin	3	11.7	15	11.6	23.4	18.1	10.6	10.6
60 Mecklenburg	38	6.1	188	6.3	10.3	9.9	8.2	8.8
61 Mitchell	2	13.7	9	12.3	12.9	7.8	5.9	8.3
62 Montgomery	3	12.1	16	13.2	13.7	13.8	11.6	13.2
63 Moore	10	14.1	37	10.9	7.6	9.4	5.7	7.0
64 Nash	5	5.7	35	8.2	16.1	9.5	11.6	8.9
65 New Hanover	12	8.1	71	10.0	8.3	11.2	9.3	10.3
66 Northampton	2	9.6	11	10.6	17.7	13.9	10.2	8.5
67 Onslow	12	8.1	34	4.6	14.3	10.6	9.5	11.5
68 Orange	9	8.2	41	7.7	12.2	8.6	6.5	11.0
69 Pamlico	1	8.3	8	13.4	7.6	3.7	2.7	10.5
70 Pasquotank	2	5.8	17	10.0	13.5	9.3	7.1	9.6
71 Pender	5	13.1	22	12.3	3.8	11.8	16.2	12.3
72 Perquimans	1	9.1	3	5.6	18.3	13.8	13.8	5.0
73 Person	4	12.0	20	12.3	6.8	11.6	14.4	11.5
74 Pitt	14	11.1	58	9.6	9.5	11.0	12.4	13.0
75 Polk	2	12.0	10	12.4	9.1	9.5	5.1	6.8
76 Randolph	14	11.3	47	7.9	9.7	9.3	6.4	8.4
77 Richmond	8	17.6	33	14.5	17.2	14.4	12.0	14.0
78 Robeson	8	7.0	56	10.0	14.9	13.7	14.5	12.5
79 Rockingham	13	14.5	59	13.3	11.3	8.3	10.6	12.0
80 Rowan	14	11.2	62	10.3	10.9	8.1	8.1	8.9
81 Rutherford	4	6.7	27	9.1	12.5	7.4	7.2	7.6
82 Sampson	5	9.4	29	11.2	9.2	10.4	12.1	10.4
83 Scotland	4	11.4	25	14.3	15.1	12.7	9.1	16.3
84 Stanly	5	9.0	21	7.7	13.1	8.1	8.7	7.1
85 Stokes	6	13.9	19	9.1	13.1	4.2	6.9	9.9
86 Surry	10	14.7	48	14.5	7.4	10.4	7.8	12.4
87 Swain	5	41.1	11	18.6	9.3	17.8	11.3	15.2
88 Transylvania	1	3.5	7	5.1	1.7	7.8	7.1	3.4
89 Tyrrell	1	25.7	2	10.6	9.2	4.0	26.0	7.5
90 Union	4	3.6	37	7.2	20.4	9.3	9.6	10.4
91 Vance	6	14.4	27	13.3	13.4	10.1	11.9	13.6
92 Wake	27	4.7	136	5.1	9.9	10.1	7.7	8.3
93 Warren	3	15.9	12	13.2	22.2	21.0	11.6	9.5
94 Washington	1	7.6	6	8.9	14.5	21.5	9.3	7.9
95 Watauga	1	2.4	11	5.5	5.8	5.8	5.5	6.5
96 Wayne	8	7.1	42	7.5	14.7	10.9	9.6	9.3
97 Wilkes	8	12.6	34	10.9	9.1	11.7	10.6	10.4
98 Wilson	4	5.8	16	4.7	12.9	8.7	4.2	4.7
99 Yadkin	2	5.6	16	9.3	7.9	7.0	8.8	8.1
100 Yancey	3	18.1	8	9.8	5.2	4.0	5.9	7.2

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Nephritis and Nephrosis

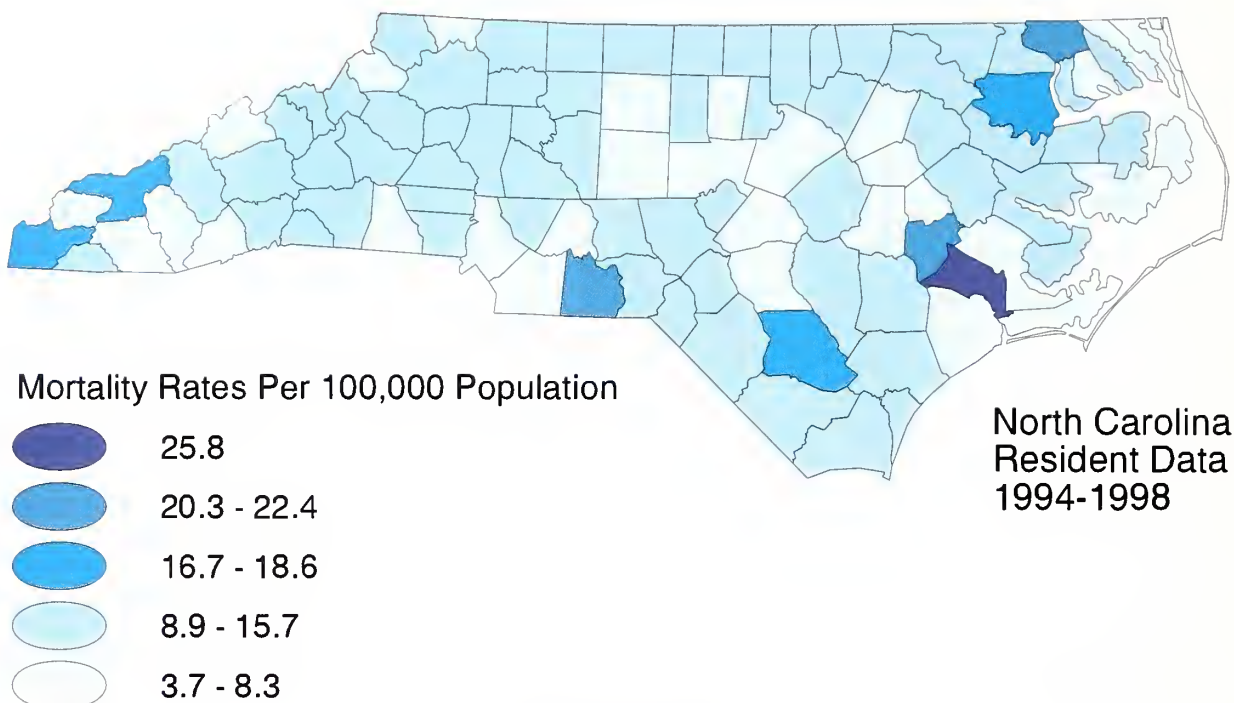


Figure 15.C

Nephritis and Nephrosis

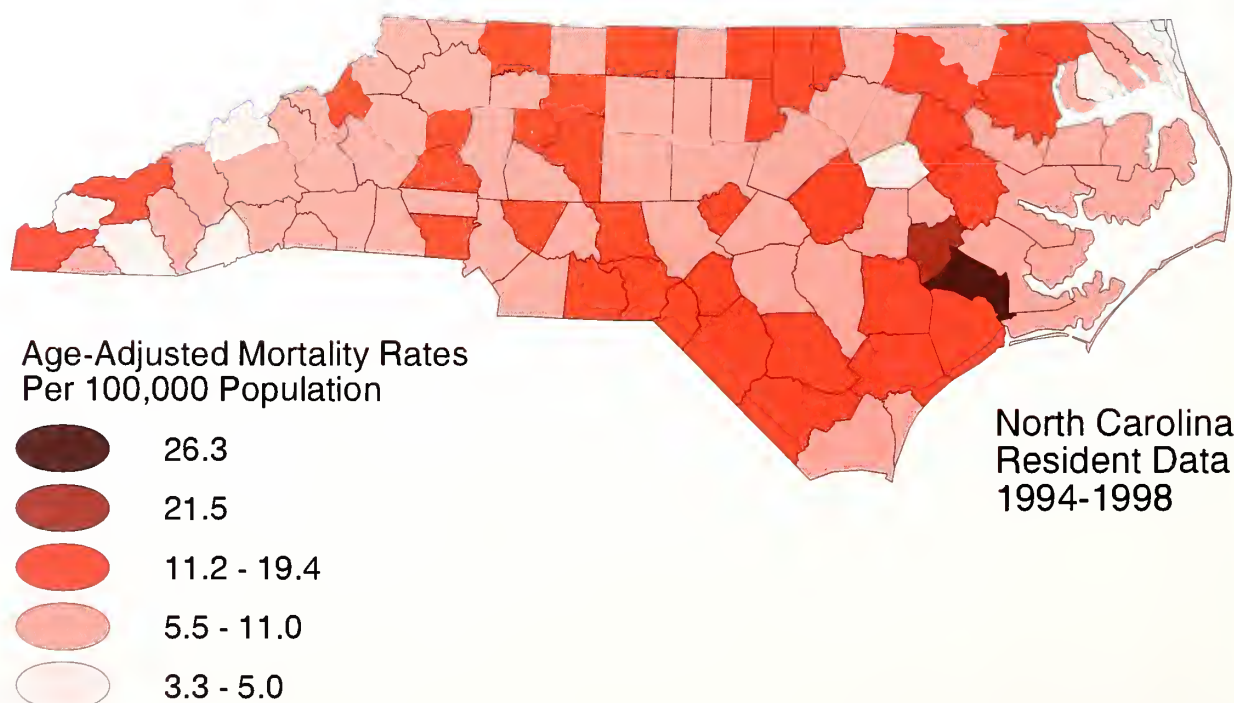


Figure 15.D

Unintentional Injury (Motor Vehicle and Other)

Introduction

While heart disease and cancer consistently contribute to more deaths than other leading causes, injuries (both unintentional motor vehicle and all other unintentional injuries) represent another significant contributor to deaths of North Carolina residents. Since 1935 unintentional injuries have remained among the leading causes of death in North Carolina.¹ In 1935, unintentional injuries represented 7.1 percent of total deaths. This percentage decreased to 4.7 percent in 1998. Unintentional injury deaths are amenable to reduction through public policy and effective education.

Injury deaths are coded according to the circumstances and behaviors that preceded them,² sometimes referred to as external causes of injury (thus E codes). Unintentional injury deaths refer to those deaths without a plan of inflicting personal harm. By ICD codes, unintentional injuries (E800-E949) have been subdivided into unintentional motor vehicle injuries (E810-E825) and all other unintentional injuries (E800-E807, E826-E949).

Differentials and Trends

In 1998, 3,218 North Carolinians died from unintentional injuries. Unintentional motor vehicle injuries contributed 1,632 deaths representing a rate of 21.6 deaths per 100,000 population; other unintentional injuries contributed 1,586 deaths representing a rate of 21.0 deaths per 100,000 population.

The 1998 rates represent an overall decrease during the past twenty years. In 1979 the age-adjusted death rate for unintentional motor vehicle injuries was 25.2 per 100,000 population. This rate decreased to 21.5 in 1998. The same pattern occurred with all other unintentional injuries, with a decrease in the age-adjusted rate from 29.7 in 1979 to 21.6 in 1998.

A striking difference, which has been the focus of current research, is the disparity in male and female unintentional motor vehicle injury death rates.³ In 1998 the age-adjusted male death rate of 30.8 was more than two times the female death rate of 13.1. The disparity has persisted since 1979 where the male rate (38.8) was more than three times the female rate (12.6).

These consistencies are mirrored at the national level. "Young men are two and one-half times as likely to die in motor vehicle accidents (than females) . . . even into their forties, men are more than twice as likely to die from motor vehicle accidents".⁴ Teens are over-represented among national motor vehicle deaths. While constituting 10 percent of the total population, 15 percent of motor vehicle deaths are among teenagers.⁴ This has led to increased efforts to reduce the disparities by discouraging risk-taking behavior prevalent in adolescent males. Graduated driver licensing is one such intervention strategy.

Large differences by sex are also observed within racial groups. The age-adjusted 1994-1998 minority male rate for all other unintentional injuries of 41.2 was more than three times the rate for minority females (13.9). For white males the 1994-98 age-adjusted rate was 29.1, compared to 13.1 for white females. Similar patterns are observed for motor vehicle injury deaths.

Unintentional injuries also contribute significantly to disability and hospitalization. In 1994, 4.5 million Americans were hospitalized and nearly 35 million visited emergency rooms because of

injuries. Medicaid expenses attributable to unintentional injuries were estimated at nearly \$80 billion. When linked to loss of income and productivity, the estimate increases to \$224 billion.⁴ Implementing additional programs such as workplace safety education and graduated driver licensing may help decrease the negative health impact of unintentional injuries.

Risk Factors

Unintentional motor vehicle injury deaths occur to drivers or pedestrians on public roads. Alcohol use has consistently been documented as a primary cause of motor vehicle deaths. The National Highway Transportation Safety Administration notes that the rate of alcohol-related motor vehicle deaths has declined from 1987 to 1996. This can be attributed to engineering improvements, and the passage/enforcement of laws limiting drinking to ages 21 and over.⁵

Unintentional injury deaths caused by firearm usage are closely related to lack of secure storage and gun safety training.⁶ In addition, it has been suggested that wearing highly visible clothing during hunting would decrease firearm injuries and deaths.⁷ Alcohol consumption is also a strong risk factor for all types of non-motor-vehicle unintentional injuries.

Geographic Patterns

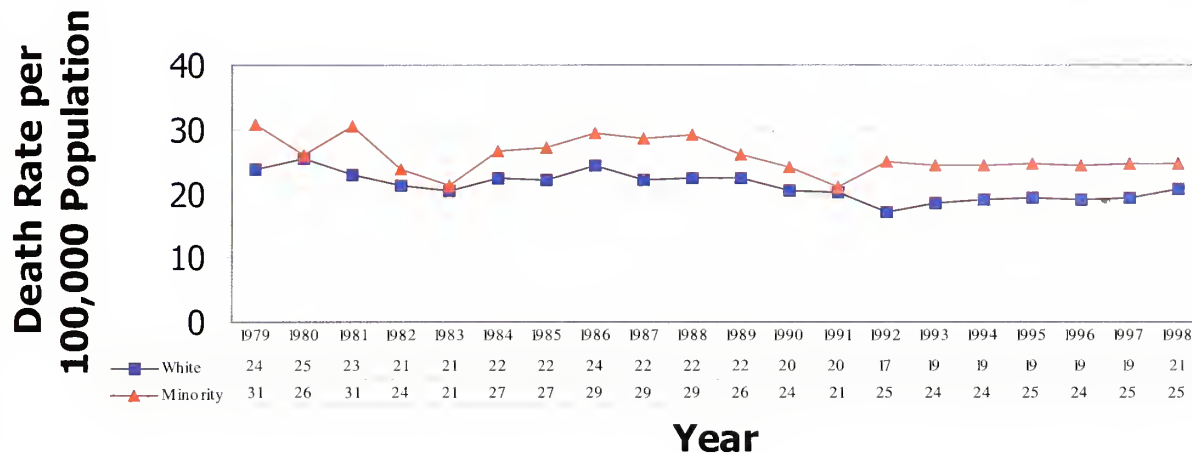
There is a significant clustering of motor vehicle injury death rates in the eastern and southeastern North Carolina counties. Seven counties in the two highest age-adjusted rate levels are in the southeastern region.

There is no discernible geographic patterns of the unadjusted all other unintentional injury death rates. After age-adjustment, there are clusters of high-rate counties in the eastern and southeastern region of North Carolina, and also an area of elevated rates in northwestern North Carolina.

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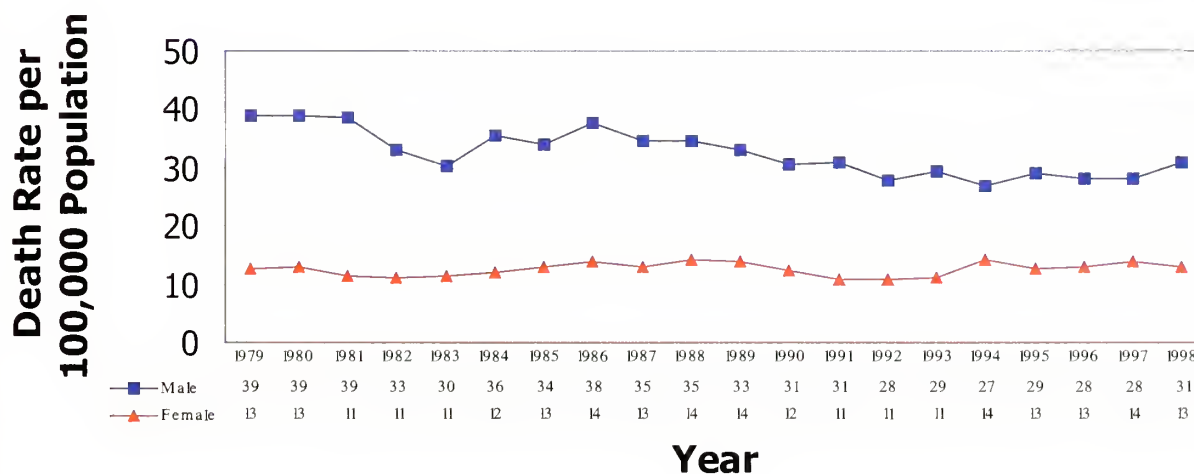
Unintentional Motor Vehicle Injuries: North Carolina Resident Age-Adjusted* Death Rates by Race 1979-1998



*U.S. 2000 standard population

Figure 16.A

Unintentional Motor Vehicle Injuries: North Carolina Resident Age-Adjusted* Death Rates by Sex 1979-1998



*U.S. 2000 standard population

Figure 16.B

TABLE 16
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Unintentional Motor Vehicle Injuries

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	1,632	21.6	7,607	20.8	23.4	23.8	20.6	20.6
1 Alamance	21	17.3	96	16.3	22.7	20.7	17.4	15.8
2 Alexander	5	15.7	33	21.5	30.6	32.0	26.0	21.4
3 Alleghany	1	10.1	9	18.6	35.8	13.1	33.9	17.8
4 Anson	8	33.3	48	40.2	26.5	31.6	21.3	40.7
5 Ashe	7	29.5	27	23.1	19.6	20.5	17.5	21.6
6 Avery	4	26.1	8	10.5	21.8	21.7	18.9	9.6
7 Beaufort	11	25.3	57	26.3	25.3	26.3	24.4	26.8
8 Bertie	8	39.9	37	36.3	36.7	50.4	34.7	35.8
9 Bladen	9	29.2	52	34.6	30.6	33.8	38.0	34.4
10 Brunswick	16	23.8	91	28.9	39.3	35.1	32.6	29.3
11 Buncombe	27	14.0	146	15.4	21.4	17.5	16.1	15.4
12 Burke	16	19.0	86	20.9	17.1	22.4	19.3	20.7
13 Cabarrus	17	14.1	83	14.6	21.4	23.8	15.8	14.6
14 Caldwell	19	25.2	84	22.6	20.7	23.9	20.2	23.1
15 Camden	2	31.4	9	28.5	20.1	24.8	25.7	28.4
16 Carteret	9	15.2	60	20.6	21	22.3	20.8	20.7
17 Caswell	3	13.4	28	25.8	28.8	36.0	30.0	25.4
18 Catawba	36	27.4	155	24.2	25.2	27.1	24.8	24.2
19 Chatham	16	34.8	68	30.9	26	32.3	34.0	31.4
20 Cherokee	6	26.3	19	17.2	22	21.6	15.4	16.5
21 Chowan	0	0.0	13	18.4	30.6	28.2	21.9	17.3
22 Clay	2	24.3	12	30.4	15.4	27.8	15.6	30.4
23 Cleveland	30	32.7	110	24.5	27.0	20.3	22.6	24.5
24 Columbus	27	51.8	104	40.3	36.6	43.7	38.1	39.7
25 Craven	19	21.3	83	19.1	17.3	21.2	15.0	18.8
26 Cumberland	52	17.8	301	20.5	22.5	24.9	19.4	20.4
27 Currituck	4	23.3	19	23.4	23.7	30.9	46.8	22.7
28 Dare	6	21.3	22	16.6	26.5	23.0	16.4	18.0
29 Davidson	39	27.6	144	20.8	25.2	25.4	22.3	20.9
30 Davie	6	18.7	30	19.6	19.0	30.4	26.3	20.0
31 Duplin	17	38.4	99	45.7	30.9	33.6	28.5	46.5
32 Durham	32	15.9	143	14.6	11.8	15.8	11.6	14.3
33 Edgecombe	11	20.1	63	22.6	26.5	23.6	27.6	23.0
34 Forsyth	46	15.9	192	13.5	18.6	14.3	14.3	13.6
35 Franklin	13	29.3	68	32.0	41.6	33.7	36.4	31.7
36 Gaston	38	21.0	163	18.2	22.7	22.9	19.4	18.1
37 Gates	4	40.0	20	40.6	27.3	53.3	55.7	39.3
38 Graham	6	80.4	16	42.8	20.9	20.9	4.7	40.2
39 Granville	11	24.7	57	27.0	29.9	35.2	25.0	27.3
40 Greene	6	32.7	32	37.1	43.0	32.6	24.0	37.8
41 Guilford	62	16.0	309	16.4	19.3	19.5	16.1	16.2
42 Halifax	16	28.9	81	28.7	26.7	27.1	32.3	29.3
43 Harnett	19	22.7	114	28.8	37.7	32.1	28.7	29.0
44 Haywood	8	15.5	33	13.1	18.1	25.9	16.9	13.3
45 Henderson	17	21.0	81	20.8	22.8	24.9	21.2	21.3
46 Hertford	10	46.4	34	30.7	27.7	32.3	25.1	30.6
47 Hoke	6	20.0	47	33.3	30.9	19.6	26.6	33.1
48 Hyde	1	17.4	6	22.5	30.1	33.2	37.8	22.2
49 Iredell	25	22.0	112	21.0	22.4	28.2	22.1	21.0
50 Jackson	4	13.5	25	17.2	15.9	13.7	21.4	16.3

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 16 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Unintentional Motor Vehicle Injuries

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	32	29.7	148	29.8	33.3	38.8	29.3	29.8
52 Jones	1	10.8	15	32.2	30.3	39.5	23.1	30.8
53 Lee	13	26.7	65	27.6	25.7	30.3	30.6	28.3
54 Lenoir	23	39.3	64	21.7	26.7	28.3	24.9	21.3
55 Lincoln	12	20.3	70	24.6	28.2	32.1	26.9	24.5
56 McDowell	11	27.4	52	27.1	23.5	26.5	22.4	27.3
57 Macon	6	21.3	31	23.0	22.2	18.9	15.5	20.6
58 Madison	3	16.0	15	16.5	26.5	25.1	29.6	16.1
59 Martin	7	27.3	27	20.9	32.6	26.1	35.9	20.7
60 Mecklenburg	74	11.8	366	12.3	17.5	16.0	13.3	12.3
61 Mitchell	2	13.7	13	17.7	42.6	29.1	21.9	16.2
62 Montgomery	7	28.3	38	31.4	29.7	32.0	23.8	30.7
63 Moore	19	26.8	82	24.1	27.3	31.8	28.1	25.9
64 Nash	19	21.6	106	24.8	34.8	28.7	25.0	24.9
65 New Hanover	20	13.5	76	10.7	17.6	18.8	13.5	10.3
66 Northampton	9	43.4	35	33.7	30.8	33.8	23.4	33.4
67 Onslow	32	21.5	162	21.8	17.8	23.0	17.6	22.2
68 Orange	8	7.3	66	12.4	26.2	17.9	17.2	12.4
69 Pamlico	5	41.3	18	30.1	45.4	35.3	24.4	31.4
70 Pasquotank	4	11.5	21	12.4	17.8	19.0	18.0	12.5
71 Pender	10	26.2	48	26.7	35.0	31.4	36.4	27.2
72 Perquimans	5	45.7	21	39.0	21.8	32.0	22.9	38.6
73 Person	5	15.0	39	24.0	20.8	29.4	27.9	23.6
74 Pitt	27	21.3	129	21.4	24.4	19.6	18.8	21.9
75 Polk	1	6.0	14	17.4	12.4	36.3	32.4	16.7
76 Randolph	31	25.0	138	23.3	27.1	28.4	25.2	23.8
77 Richmond	12	26.4	84	36.9	26.4	31.8	38.3	36.8
78 Robeson	52	45.4	232	41.4	36.3	37.4	37.7	42.1
79 Rockingham	17	19.0	113	25.4	28.7	30.2	22.1	25.6
80 Rowan	39	31.3	131	21.7	22.6	22.9	23.8	21.2
81 Rutherford	18	30.0	80	27.0	29.4	29.8	24.1	26.4
82 Sampson	21	39.4	111	43.0	37.2	36.4	35.5	42.3
83 Scotland	12	34.1	58	33.2	31.9	38.9	29.0	33.4
84 Stanly	24	43.2	68	24.9	24.0	20.4	26.0	25.1
85 Stokes	12	27.8	36	17.2	29.9	23.6	20.5	16.9
86 Surry	17	25.0	80	24.2	21.4	23.4	23.5	24.9
87 Swain	2	16.4	15	25.4	43.0	25.3	28.0	26.0
88 Transylvania	5	17.7	16	11.6	16.1	22.0	10.6	11.5
89 Tyrrell	2	51.3	6	31.8	25.6	16.6	14.5	34.6
90 Union	19	17.3	129	25.3	26.0	26.2	23.6	26.2
91 Vance	5	12.0	41	20.2	24.9	29.7	25.5	20.4
92 Wake	111	19.3	377	14.0	17.4	18.6	11.4	14.3
93 Warren	6	31.7	32	35.1	32.6	39.3	30.3	35.3
94 Washington	2	15.3	22	32.6	15.1	35.5	27.9	33.3
95 Watauga	11	26.9	29	14.4	20.1	17.1	15.4	13.2
96 Wayne	21	18.5	120	21.5	24.2	22.4	21.2	21.3
97 Wilkes	24	37.9	89	28.5	27.8	26.9	27.9	28.6
98 Wilson	20	28.8	83	24.3	28.9	29.2	28.8	24.1
99 Yadkin	13	36.5	51	29.6	26.9	24.4	24.8	29.7
100 Yancey	3	18.1	16	19.7	30.3	21.1	19.8	18.9

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Motor Vehicle Injuries

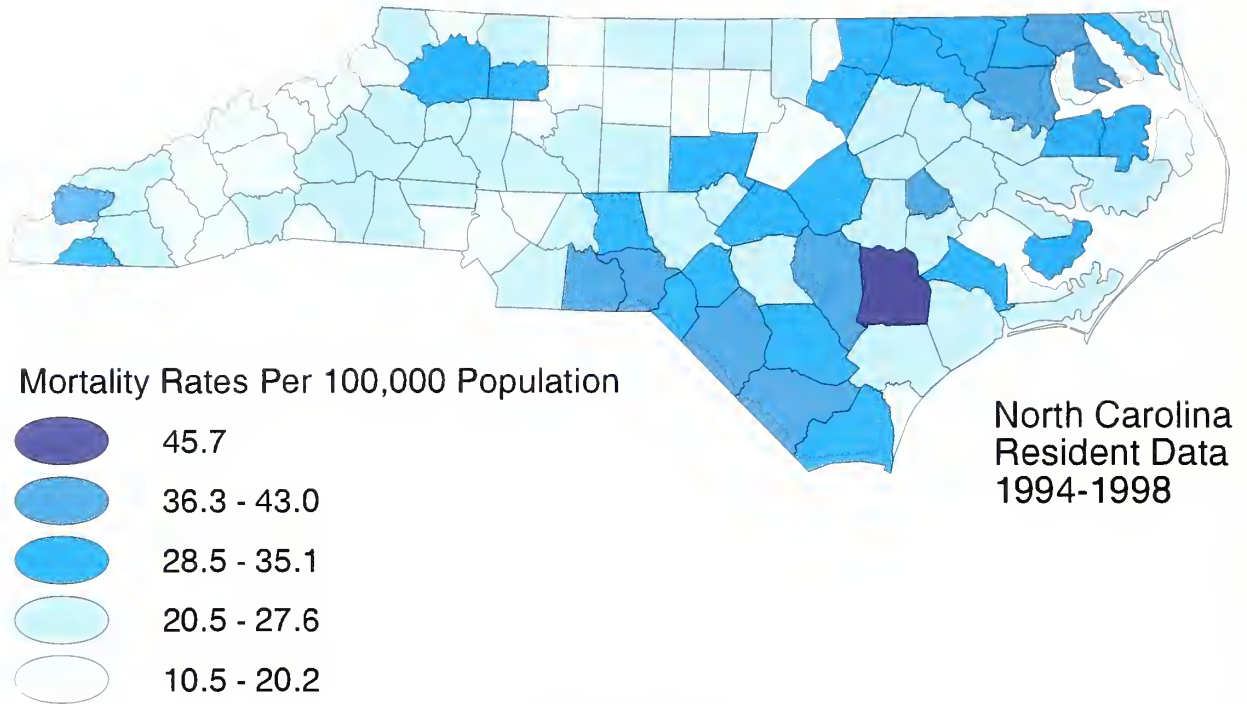


Figure 16.C

Motor Vehicle Injuries

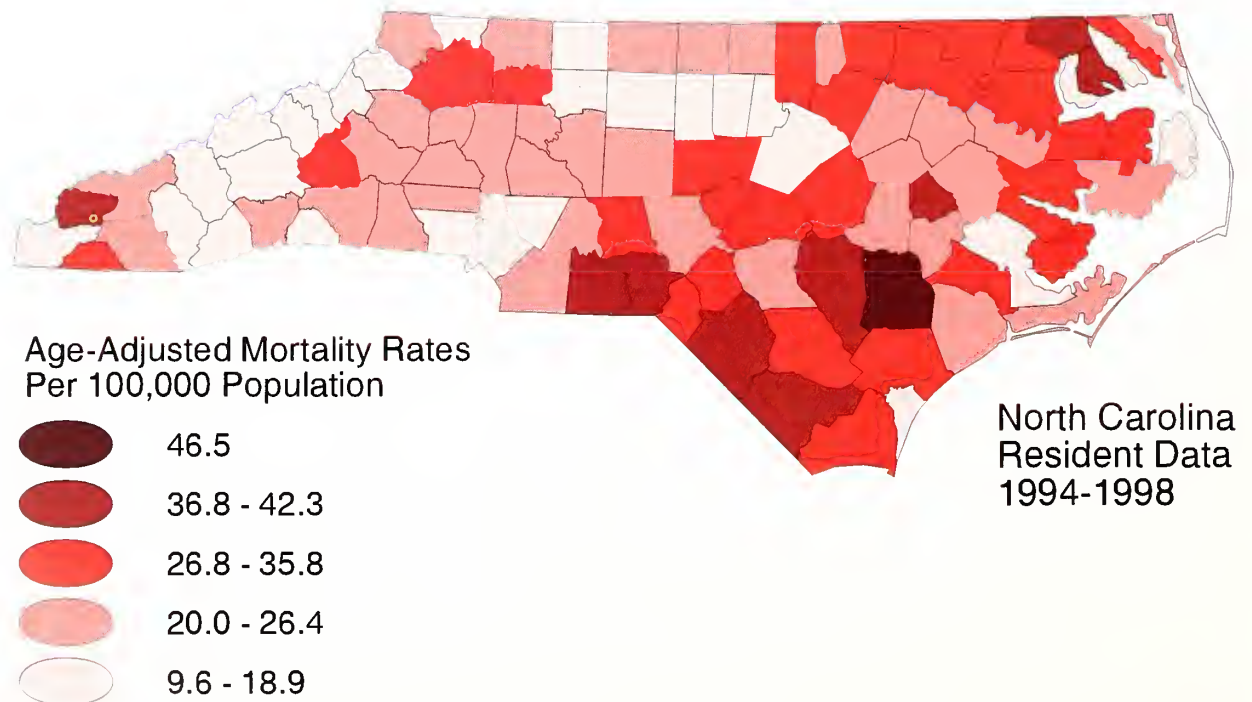
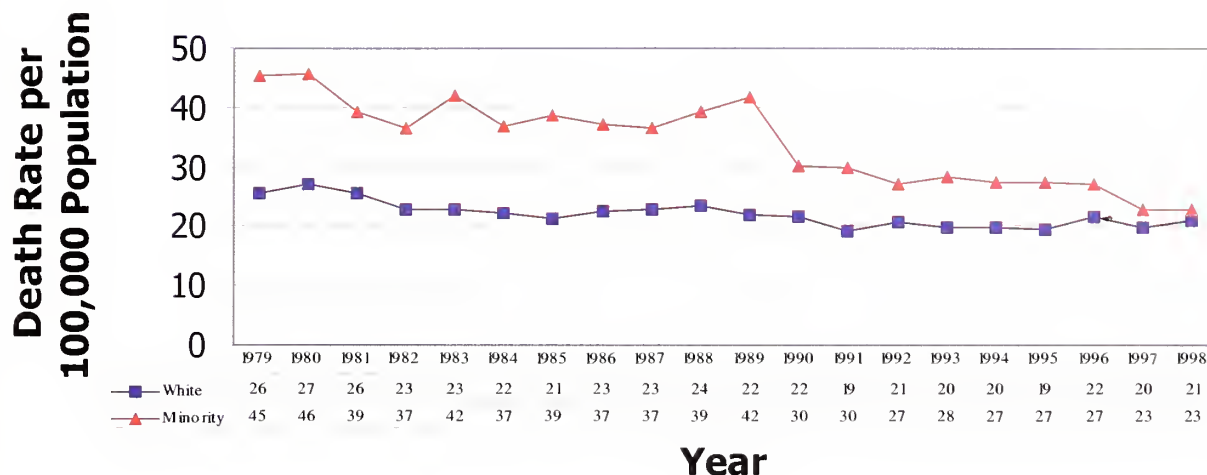


Figure 16.D

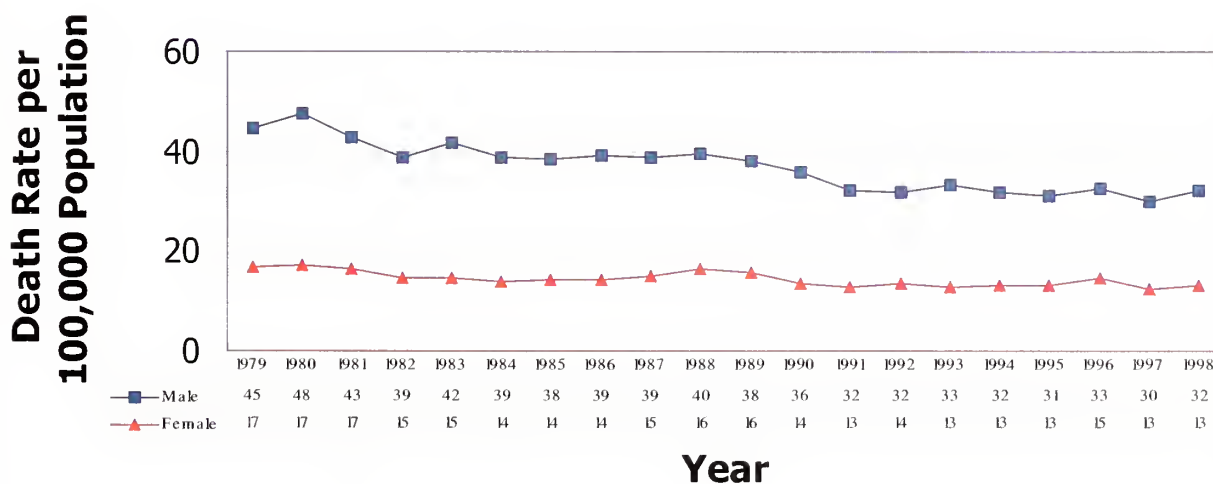
All Other Unintentional Injuries: North Carolina Resident Age-Adjusted* Death Rates by Race 1979-1998



*U.S. 2000 standard population

Figure 17.A

All Other Unintentional Injuries: North Carolina Resident Age-Adjusted* Death Rates by Sex 1979-1998



*U.S. 2000 standard population

Figure 17.B

TABLE 17
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
All Other Unintentional Injuries

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	1,586	21.0	7,578	20.7	28.4	25.8	23.0	21.5
1 Alamance	22	18.1	113	19.2	25.1	23.2	20.4	18.0
2 Alexander	8	25.1	45	29.3	37.3	20.5	25.2	30.1
3 Alleghany	5	50.7	18	37.2	27.9	14.9	22.5	26.5
4 Anson	8	33.3	31	25.9	29.3	43.4	22.2	24.7
5 Ashe	9	38.0	23	19.7	24.5	19.1	20.2	15.2
6 Avery	8	52.2	27	35.4	26.7	38.4	25.8	30.9
7 Beaufort	17	39.0	61	28.1	36.9	29.9	27.7	25.8
8 Bertie	8	39.9	34	33.4	41.9	38.3	25.7	33.2
9 Bladen	6	19.5	38	25.3	46.7	35.1	26.4	24.1
10 Brunswick	24	35.7	81	25.7	32.1	24.4	22.6	25.8
11 Buncombe	53	27.4	222	23.4	26.0	27.1	24.1	20.6
12 Burke	17	20.2	91	22.2	26.3	28.2	23.6	22.0
13 Cabarrus	22	18.2	113	19.9	26.0	20.8	16.1	20.1
14 Caldwell	8	10.6	66	17.8	29.1	19.7	17.7	18.4
15 Camden	0	0.0	6	19.0	68.7	48.3	29.5	18.6
16 Carteret	21	35.4	87	29.9	23.4	28.3	31.3	29.7
17 Caswell	6	26.8	30	27.7	24.2	29.6	18.1	25.9
18 Catawba	25	19.0	129	20.2	22.3	23.7	20.9	20.8
19 Chatham	10	21.8	39	17.7	27.6	33.6	23.2	16.5
20 Cherokee	9	39.5	38	34.4	23.2	20.7	21.7	31.0
21 Chowan	4	27.8	24	33.9	33.0	27.9	21.9	29.5
22 Clay	2	24.3	7	17.7	50.5	11.0	14.8	13.0
23 Cleveland	19	20.7	105	23.4	28.0	27.1	18.6	22.5
24 Columbus	14	26.8	80	31.0	42.5	33.8	30.5	30.7
25 Craven	24	27.0	90	20.7	31.0	21.5	23.5	21.9
26 Cumberland	55	18.8	270	18.4	28.2	31.5	24.9	24.1
27 Currituck	1	5.8	12	14.8	31.7	12.8	10.8	16.1
28 Dare	5	17.8	25	18.8	31.5	40.2	29.0	21.5
29 Davidson	23	16.3	122	17.6	24.7	21.9	25.2	18.5
30 Davie	10	31.1	39	25.5	16.4	26.6	18.0	24.2
31 Duplin	9	20.3	49	22.6	32.9	33.0	22.0	22.4
32 Durham	51	25.4	242	24.8	29.1	28.6	21.8	27.7
33 Edgecombe	26	47.5	75	26.8	37.8	31.0	29.0	27.4
34 Forsyth	55	19.0	266	18.8	23.6	25.0	22.1	18.8
35 Franklin	7	15.8	38	17.9	38.3	30.5	30.7	18.4
36 Gaston	34	18.8	174	19.4	26.2	24.5	21.7	20.2
37 Gates	4	40.0	13	26.4	17.7	29.1	31.4	26.3
38 Graham	2	26.8	7	18.7	54.3	48.8	33.5	17.4
39 Granville	6	13.5	43	20.4	37.6	26.4	19.4	21.1
40 Greene	10	54.5	22	25.5	31.9	33.7	34.3	25.7
41 Guilford	95	24.5	409	21.7	23.1	23.4	21.5	22.2
42 Halifax	10	18.0	64	22.7	34.2	27.7	33.0	22.3
43 Harnett	24	28.7	84	21.2	28.4	30.7	27.3	22.0
44 Haywood	16	31.0	63	24.9	25.8	28.5	23.0	20.3
45 Henderson	18	22.3	102	26.2	31.0	19.5	21.3	20.3
46 Hertford	9	41.7	32	28.9	34.2	43.5	31.3	27.3
47 Hoke	8	26.6	39	27.7	33.6	22.8	23.3	32.5
48 Hyde	0	0.0	2	7.5	49.5	30.6	45.3	5.6
49 Iredell	28	24.7	124	23.3	27.3	27.8	24.0	23.5
50 Jackson	10	33.8	42	28.9	28.0	21.9	21.9	27.7

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 17 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
All Other Unintentional Injuries

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	19	17.6	99	19.9	33.2	30.5	26.4	20.6
52 Jones	3	32.4	12	25.8	31.9	28.7	24.1	24.7
53 Lee	8	16.4	52	22.1	23.3	28.0	28.5	22.6
54 Lenoir	17	29.0	82	27.8	29.7	30.9	19.9	27.3
55 Lincoln	14	23.7	63	22.2	26.0	27.6	22.3	24.0
56 McDowell	12	29.9	52	27.1	32.0	23.3	22.2	25.4
57 Macon	5	17.8	38	28.2	24.2	24.6	14.5	22.9
58 Madison	4	21.3	24	26.5	38.2	38.2	23.9	22.0
59 Martin	4	15.6	34	26.4	36.7	33.7	23.2	25.6
60 Mecklenburg	117	18.7	483	16.3	25.7	21.8	19.9	19.4
61 Mitchell	2	13.7	18	24.6	32.0	22.3	32.2	21.4
62 Montgomery	4	16.2	32	26.4	28.9	28.5	30.2	26.7
63 Moore	18	25.4	80	23.5	29.4	23.8	21.3	20.8
64 Nash	19	21.6	75	17.5	33.2	33.0	27.7	18.4
65 New Hanover	27	18.2	125	17.5	26.9	23.2	21.8	17.6
66 Northampton	5	24.1	31	29.9	34.2	25.7	29.1	26.7
67 Onslow	13	8.7	91	12.3	27.2	25.0	24.4	17.3
68 Orange	15	13.7	66	12.4	20.9	18.4	19.1	15.5
69 Pamlico	4	33.1	21	35.2	36.5	48.7	22.8	33.4
70 Pasquotank	6	17.3	47	27.7	36.1	21.5	22.7	27.1
71 Pender	5	13.1	39	21.7	42.2	27.4	22.0	21.9
72 Perquimans	1	9.1	14	26.0	25.3	26.7	33.2	23.0
73 Person	2	6.0	37	22.8	29.0	20.7	26.7	22.1
74 Pitt	20	15.8	120	19.9	28.2	30.5	30.2	24.0
75 Polk	1	6.0	15	18.6	31.5	24.9	20.2	12.7
76 Randolph	22	17.7	113	19.1	23.0	19.9	19.6	19.7
77 Richmond	4	8.8	43	18.9	33.6	26.6	29.1	19.0
78 Robeson	29	25.3	145	25.9	38.4	38.2	30.7	28.1
79 Rockingham	33	36.8	109	24.5	33.4	22.6	24.2	23.0
80 Rowan	23	18.4	122	20.2	26.0	28.9	21.9	18.8
81 Rutherford	15	25.0	71	23.9	32.2	22.8	24.4	21.7
82 Sampson	8	15.0	56	21.7	42.4	30.7	32.1	21.1
83 Scotland	4	11.4	36	20.6	39.2	24.3	32.9	23.1
84 Stanly	16	28.8	63	23.1	33.7	24.0	25.4	22.6
85 Stokes	6	13.9	41	19.6	24.5	21.2	34.5	20.2
86 Surry	16	23.6	91	27.6	28.0	19.8	24.6	25.1
87 Swain	3	24.7	23	38.9	32.5	48.9	54.7	34.8
88 Transylvania	7	24.7	23	16.7	23.5	12.0	21.4	12.7
89 Tyrrell	1	25.7	3	15.9	27.1	24.8	25.8	15.0
90 Union	17	15.4	86	16.8	21.8	22.0	16.8	20.1
91 Vance	8	19.2	62	30.5	33.8	37.7	26.1	31.9
92 Wake	84	14.6	371	13.8	26.2	22.1	18.0	18.5
93 Warren	6	31.7	29	31.8	36.2	33.6	34.0	27.4
94 Washington	2	15.3	12	17.8	35.8	28.5	19.1	17.5
95 Watauga	7	17.1	30	14.9	26.8	22.1	20.6	16.6
96 Wayne	21	18.5	123	22.0	25.7	23.5	22.8	24.2
97 Wilkes	16	25.3	80	25.6	27.5	21.8	22.0	24.6
98 Wilson	15	21.6	79	23.1	36.0	25.9	24.8	23.6
99 Yadkin	7	19.6	37	21.5	26.6	30.5	23.4	19.9
100 Yancey	6	36.2	24	29.5	29.8	28.3	27.9	24.2

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

All Other Injuries and Adverse Effects

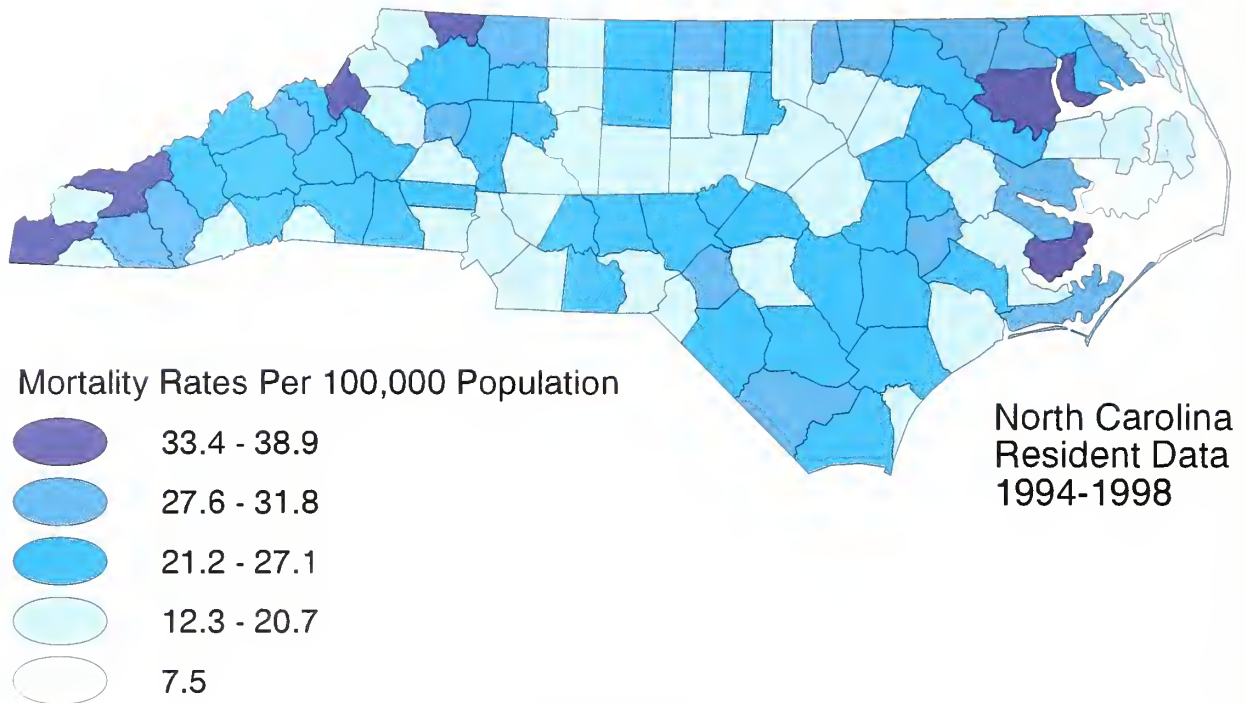


Figure 17.C

All Other Injuries and Adverse Effects

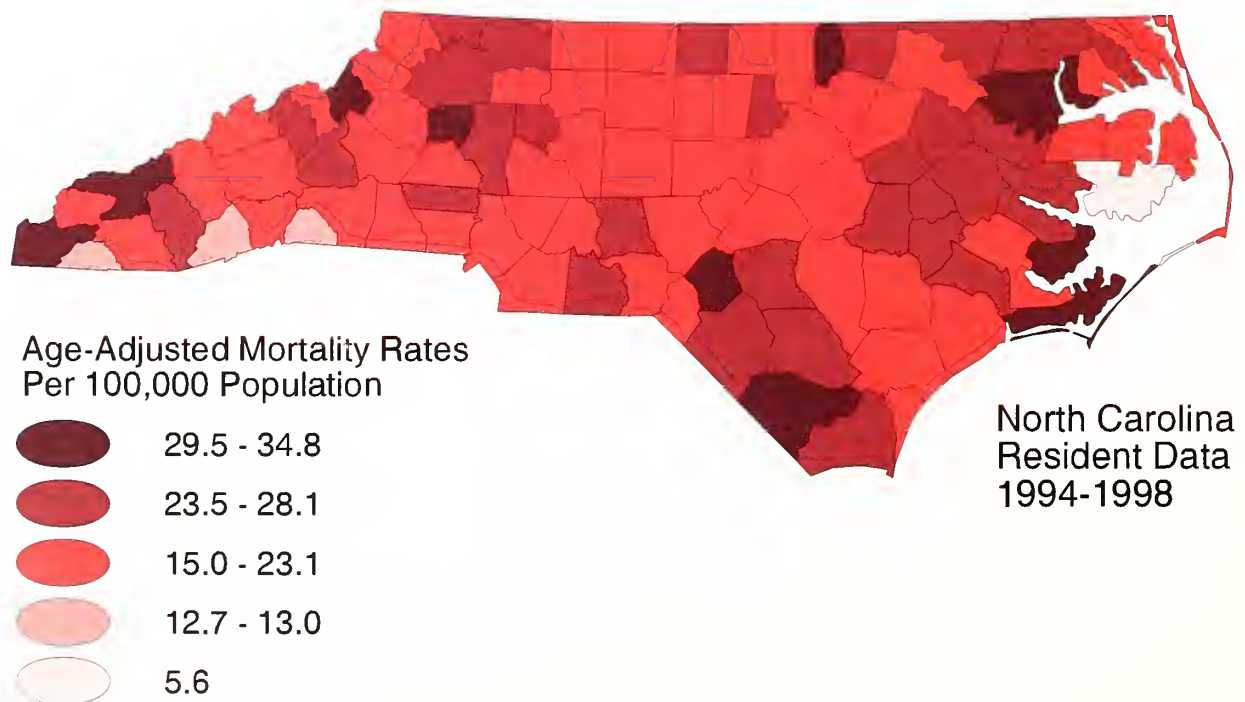


Figure 17.D

Suicide

Introduction

In 1998, suicide accounted for about one percent of all resident deaths in North Carolina. The unadjusted mortality rate from suicide was 11.2 per 100,000 population, representing 846 deaths to North Carolina residents in 1998. The highest suicide rate was observed among 75 to 84 year olds (19.7), while the next highest rate was found among 35 to 44 year olds (16.5). Furthermore, males were about four times as likely as females to commit suicide; out of a total of 846 suicide deaths in 1998, males accounted for 79.3 percent.

Suicide was the ninth leading cause of death in North Carolina in 1998. Suicide ranked fourth among 5 to 14 year olds, fourth among 15 to 24 year olds, fourth among 25 to 44 year olds, and ninth among 45 to 64 year olds.

Differentials and Trends

The age-adjusted suicide mortality rate for the state as a whole was 12.8 in 1979, increasing to a peak of 13.7 in 1982. After remaining steady for several years, the rates fell after 1990 to a low of 11.1 in 1998.

When considering large scale economic changes over the 20-year period, it is interesting to note that during periods of low job growth/high unemployment (early eighties), the suicide rate in North Carolina went up, while during periods of high job growth/low unemployment (mid-late nineties) annual suicide rates in the state have tended to decline.

Age-adjusted suicide death rates for 1994-98 differed significantly by race-sex group: 22.5 for white males, 12.9 for minority males, 5.5 for white females, and 1.9 for minority females.

Risk Factors

Epidemiological studies have found that both mental and addictive disorders, frequently in co-occurrence, account for over 90 percent of all completed suicides across all age groups.¹ Results from the National Longitudinal Alcohol Epidemiologic (NLAE) Survey revealed that major depression and alcohol dependence elevated the risk for suicidal ideation (recurrent thoughts of death or suicide) for men and women. With respect to gender differences, suicidal ideation increased among men with a past alcohol use disorder, a family history of alcoholism, and being unemployed. For women, suicidal ideation was elevated for those who had used drugs nonmedically and developed a drug use disorder in the past year. For both sexes, marriage was found to be protective.²

Our examination of North Carolina death certificates (1994-1998) showed that male suicide victims who were unemployed at the time of their death ($n=415$), were far more likely to be never married (78.3%) than married (10.1%). By contrast, among unemployed female suicide victims ($n=304$), only 25.3 percent were never married while 46.7 percent were married.

Geographic Analysis

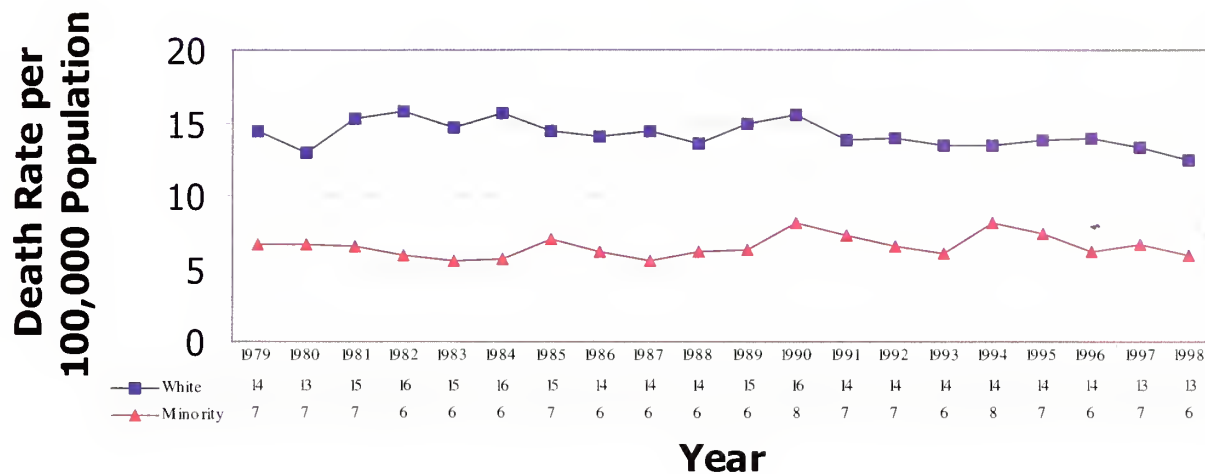
The geographic patterns of 1994-98 unadjusted and age-adjusted suicide rates are depicted in Figures 18.C and 18.D respectively. Both maps show most counties with the highest rates to be

located in western North Carolina. This is probably associated in part with the fact that western North Carolina counties have a higher proportion of whites, where suicide death rates are higher³.

References

1. Moscicki EK. Identification of suicide risk factors using epidemiologic studies. *Psychiatric Clinics of North America* 1997; 20:499-517.
2. Caces F, Hartford T. Time series analysis of alcohol consumption and suicide mortality in the United States, 1934-1987. *Journal of the Study of Alcohol* 1998; 59:455-461.
3. Surles KB. Suicide in North Carolina. *SCHS Studies*, No. 110, State Center for Health Statistics, 1998.

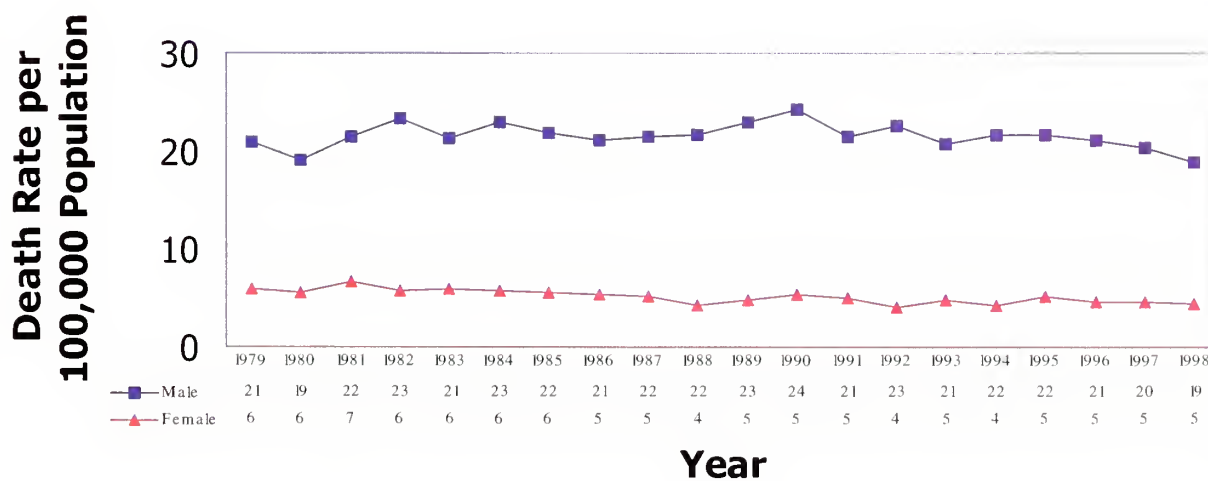
Suicide:
North Carolina Resident
Age-Adjusted* Death Rates by Race 1979-1998



*U.S. 2000 standard population

Figure 18.A

Suicide:
North Carolina Resident
Age-Adjusted* Death Rates by Sex 1979-1998



*U.S. 2000 standard population

Figure 18.B

TABLE 18
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Suicide

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	846	11.2	4,446	12.2	12.9	12.7	12.8	12.0
1 Alamance	12	9.9	89	15.1	13.5	13.8	11.9	14.6
2 Alexander	4	12.5	24	15.6	17.9	17.1	18.7	15.4
3 Alleghany	2	20.3	10	20.7	22.1	19.5	22.8	20.3
4 Anson	3	12.5	18	15.1	10.2	19.6	14.9	14.6
5 Ashe	6	25.3	24	20.6	21.6	15.9	17.3	20.4
6 Avery	3	19.6	21	27.5	11.5	3.5	16.8	24.7
7 Beaufort	7	16.1	29	13.4	10.6	13.3	13.8	13.0
8 Bertie	1	5.0	4	3.9	14.5	10.6	15.2	3.7
9 Bladen	3	9.7	18	12.0	10.2	12.2	12.9	12.2
10 Brunswick	6	8.9	49	15.6	13.8	11.1	16.4	15.1
11 Buncombe	25	12.9	144	15.2	14.7	14.4	14.8	14.7
12 Burke	12	14.3	64	15.6	11.6	16.3	15.4	14.9
13 Cabarrus	11	9.1	66	11.6	14.6	11.1	12.8	11.3
14 Caldwell	10	13.3	54	14.5	18.1	14.5	14.8	13.7
15 Camden	1	15.7	5	15.8	19.3	15.7	15.1	16.2
16 Carteret	6	10.1	36	12.4	7.5	12.6	14.8	12.1
17 Caswell	4	17.9	16	14.7	13.2	7.8	14.0	14.6
18 Catawba	15	11.4	74	11.6	12.4	11.3	14.5	11.3
19 Chatham	5	10.9	29	13.2	9.9	13.3	12.1	12.6
20 Cherokee	8	35.1	21	19.0	7.7	15.6	12.4	18.1
21 Chowan	0	0.0	2	2.8	12.6	9.6	7.7	2.6
22 Clay	1	12.1	5	12.7	21.0	12.3	14.0	12.0
23 Cleveland	16	17.4	63	14.0	11.3	11.2	10.6	13.7
24 Columbus	9	17.3	35	13.6	16.0	10.0	12.3	13.5
25 Craven	5	5.6	40	9.2	10.9	13.0	15.5	9.3
26 Cumberland	33	11.3	179	12.2	15.0	11.5	10.7	13.1
27 Currituck	2	11.7	16	19.7	14.1	26.1	13.1	20.1
28 Dare	8	28.4	20	15.1	9.8	16.5	12.0	14.0
29 Davidson	13	9.2	89	12.9	13.1	12.3	11.6	12.7
30 Davie	5	15.5	17	11.1	15.1	14.8	16.4	11.0
31 Duplin	5	11.3	24	11.1	7.1	11.7	13.3	10.8
32 Durham	21	10.5	107	10.9	10.5	11.2	12.4	11.0
33 Edgecombe	8	14.6	24	8.6	11.4	10.5	13.1	8.9
34 Forsyth	30	10.4	165	11.6	13.3	11.7	13.8	11.4
35 Franklin	5	11.3	35	16.5	12.0	8.4	13.7	16.5
36 Gaston	34	18.8	136	15.2	14.0	11.2	12.8	15.0
37 Gates	0	0.0	5	10.1	8.7	7.4	19.4	10.2
38 Graham	2	26.8	7	18.7	15.7	7.2	9.0	17.4
39 Granville	9	20.2	38	18.0	15.0	15.1	12.9	17.8
40 Greene	0	0.0	11	12.7	6.9	11.6	8.0	12.5
41 Guilford	38	9.8	220	11.7	13.2	12.6	11.8	11.4
42 Halifax	5	9.0	29	10.3	9.5	9.6	10.6	10.2
43 Harnett	13	15.6	63	15.9	15.4	14.9	11.4	16.0
44 Haywood	8	15.5	38	15.0	11.5	14.2	13.6	14.4
45 Henderson	11	13.6	71	18.3	11.8	18.1	12.7	16.7
46 Hertford	2	9.3	10	9.0	9.6	8.6	6.5	9.3
47 Hoke	1	3.3	15	10.6	10.4	8.8	4.2	11.2
48 Hyde	2	34.8	6	22.5	11.0	24.7	8.1	22.1
49 Iredell	11	9.7	68	12.8	12.0	13.9	14.2	12.5
50 Jackson	6	20.3	21	14.5	15.9	15.1	15.6	13.7

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 18 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Suicide

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	6	5.6	69	13.9	18.5	17.4	16.1	13.7
52 Jones	1	10.8	6	12.9	12.5	12.0	2.2	12.4
53 Lee	9	18.5	29	12.3	12.0	13.0	10.1	12.2
54 Lenoir	5	8.5	34	11.5	13.4	14.2	12.9	11.5
55 Lincoln	12	20.3	42	14.8	13.2	14.7	15.3	14.6
56 McDowell	3	7.5	16	8.3	10.2	11.9	8.4	8.0
57 Macon	6	21.3	21	15.6	15.8	15.3	16.4	15.0
58 Madison	4	21.3	17	18.7	9.2	13.2	18.5	17.6
59 Martin	5	19.5	15	11.6	10.0	12.6	12.9	11.2
60 Mecklenburg	61	9.8	289	9.7	10.8	11.6	11.5	9.8
61 Mitchell	1	6.8	11	15.0	15.1	16.7	11.0	13.9
62 Montgomery	9	36.4	22	18.2	14.1	11.6	14.9	18.3
63 Moore	16	22.6	52	15.3	12.1	15.0	14.3	14.6
64 Nash	3	3.4	43	10.0	12.3	11.2	14.6	10.0
65 New Hanover	11	7.4	80	11.2	13.6	12.1	15.8	10.9
66 Northampton	3	14.5	9	8.7	10.1	8.5	9.8	8.5
67 Onslow	14	9.4	74	10.0	11.0	10.7	13.9	10.6
68 Orange	6	5.5	50	9.4	7.4	12.9	13.8	9.3
69 Pamlico	2	16.5	9	15.1	16.2	14.5	13.3	14.4
70 Pasquotank	2	5.8	14	8.2	10.0	7.2	11.1	8.2
71 Pender	1	2.6	21	11.7	15.9	14.6	13.7	12.3
72 Perquimans	1	9.1	9	16.7	4.2	17.1	16.7	14.9
73 Person	7	21.0	22	13.6	21.1	14.2	15.4	13.5
74 Pitt	16	12.6	63	10.4	15.5	13.7	14.0	10.8
75 Polk	2	12.0	16	19.9	18.3	12.5	21.7	17.5
76 Randolph	10	8.1	69	11.6	14.4	12.8	11.9	11.5
77 Richmond	6	13.2	37	16.3	9.9	7.2	12.5	16.1
78 Robeson	15	13.1	62	11.1	10.1	10.2	11.0	11.3
79 Rockingham	12	13.4	50	11.3	15.5	17.0	13.0	10.9
80 Rowan	14	11.2	80	13.2	13.2	15.1	11.1	13.0
81 Rutherford	7	11.7	52	17.5	11.3	14.4	12.9	17.2
82 Sampson	4	7.5	28	10.9	15.4	14.3	11.4	10.7
83 Scotland	4	11.4	12	6.9	4.7	11.8	11.9	7.1
84 Stanly	7	12.6	38	13.9	15.2	17.7	13.9	13.6
85 Stokes	9	20.8	49	23.4	14.6	12.8	20.1	22.3
86 Surry	7	10.3	52	15.8	17.4	17.9	14.1	14.4
87 Swain	3	24.7	8	13.5	17.2	20.1	14.9	14.2
88 Transylvania	1	3.5	16	11.6	7.4	18.2	14.8	11.1
89 Tyrrell	0	0.0	1	5.3	8.7	10.2	0.0	3.7
90 Union	9	8.2	49	9.6	13.4	12.4	11.9	9.7
91 Vance	4	9.6	16	7.9	10.3	9.6	11.2	8.1
92 Wake	35	6.1	218	8.1	13.4	9.1	10.6	8.5
93 Warren	3	15.9	11	12.1	19.2	10.7	11.9	11.3
94 Washington	2	15.3	9	13.3	13.3	9.4	9.3	13.1
95 Watauga	8	19.5	28	13.9	25.3	10.2	17.9	14.6
96 Wayne	12	10.6	58	10.4	12.1	12.9	10.4	10.4
97 Wilkes	3	4.7	36	11.5	18.1	18.7	14.8	10.9
98 Wilson	11	15.9	53	15.5	17.5	18.2	13.4	15.4
99 Yadkin	4	11.2	20	11.6	12.3	16.2	15.0	11.6
100 Yancey	3	18.1	7	8.6	10.4	11.9	14.1	8.4

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Suicide

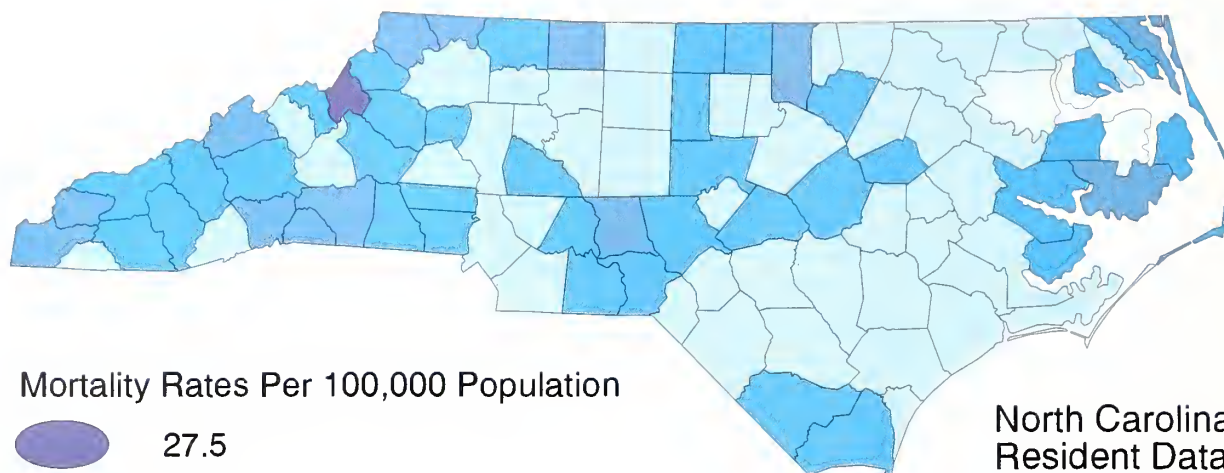


Figure 18.C

Suicide

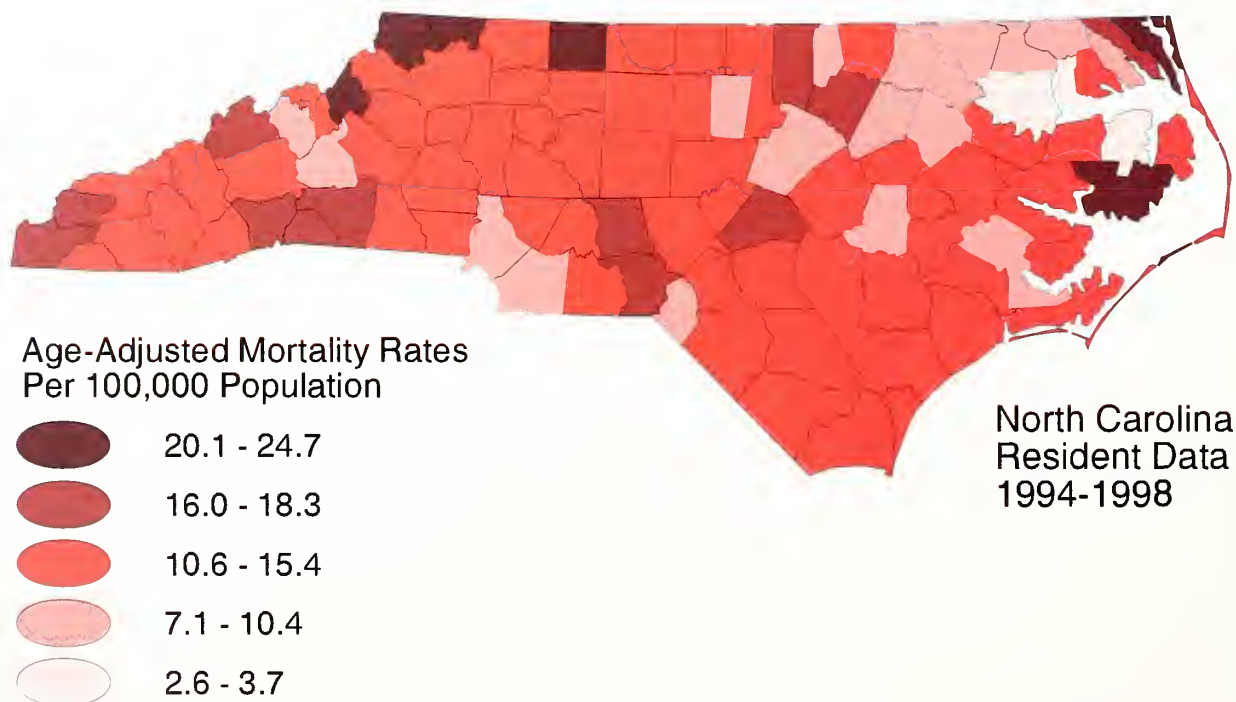


Figure 18.D

Homicide

Introduction

In 1998, there were 664 homicides in North Carolina, which represents about one percent of all deaths in the state. The overall unadjusted rate of death from homicide was 8.8 per 100,000 population in 1998.

Differentials and Trends

For all deaths in 1998, homicide is not one of the ten leading causes of death. However, that changes when different age, race, and sex categories are examined separately. For all age categories under 45 years old, homicide was one of the ten leading causes of death. For deaths of 15 to 24 year olds, homicide was the second most frequent cause of death with motor vehicle injuries being the first. There were 163 deaths due to homicide in this age group which represents 17 percent of all deaths of individuals 15 to 24 years old.

There are also differences in the leading causes of death by race and ethnicity. For blacks and American Indians, homicide is one of the top ten causes of death for 1998 but it is not for whites. Among blacks, 2.4 percent of all deaths are due to homicide, and 3.9 percent for American Indians. This compares to only one percent of all deaths in North Carolina for 1998. Hispanic deaths are also disproportionately due to homicide, at 14 percent of all deaths. Homicide is the second leading cause of death among Hispanics with motor vehicle injuries being the first.

During 1994-98, the group with the highest rate of homicide deaths was minority males between 15 and 24 years of age, where the rate was 74.7. This is 6.4 times higher than the rate of 11.7 for white males in the same age group. The next highest rate was 71.9 for minority males ages 25 to 34, whose white counterparts had a rate of 13.2. The homicide rates for minority females are not only higher than those of white females, but also exceed or equal those of white males in several age groups. The largest difference is found in the 25-34 age group where minority females had a homicide death rate of 18.6 compared to 13.2 for white males of the same age.

Over the past 20 years, the age-adjusted rate of homicide death in North Carolina has varied considerably. In 1979, the overall age-adjusted rate of death from homicide was 11.7. This rate declined over the next few years. From 1983 through 1988, the rate remained between 8.5 and 9.1. This trend reversed in 1989 when it increased to 10.2. This increase continued until a high of 12.5 was reached in 1991 when there were 889 deaths due to homicide. Between 1991 and 1994 the rate of deaths from homicide remained over 11 and then began to decrease in 1995 to a low of 8.6 in 1998.

Risk Factors

Looking at the rates of death by homicide over the past 20 years, there are certain demographic characteristics that have remained risk factors for being the victim of homicide. There are rather extreme disparities in the homicide rates by sex, race, and age. Males have consistently had rates three to four times as high as those of females. In the past twenty years, the age-adjusted rate of male deaths due to homicide has ranged from 12.9 in 1988 to 19.6 in 1991. There has been less variation in the rates for females. The lowest rate of female deaths to homicide was in 1998 when it was 3.9 and the highest rate was 5.8 in 1991.

The racial differences in homicide death rates are also large. The rate of death due to homicide for minorities is more than four times as high as that of whites. Over the past 20 years, there has been some fluctuation in the amount of difference. In the mid 1980's the age-adjusted rate of minority deaths was approximately 3.5 times as high as the white rate, with rates around 20 for minorities and 5.5 for whites. This difference increased in the early 1990's with minority rates in the upper twenties (27.1 to 29.6) which was 4.5 times the white rates for those years.

In 1995 handguns were the most frequent means of death in homicides. Firearms (all types) were used in 74 percent of the homicides. This represents an increase from 1988 when firearms were the means of death in 64 percent of homicide cases.

The medical examiner performs autopsies and blood alcohol tests on all deaths that are suspected homicides. Alcohol is involved in a significant percentage of all homicides. In approximately 40 percent of homicide deaths in 1995, alcohol was present in the victim. However, this varied by age group with those between 25 and 64 years old having alcohol present in almost 50 percent of the cases.¹

There has been much research about ways to reduce homicides. However, unlike deaths that are the result of a disease or other health problems, homicide involves many social issues. There has been much research showing that drug and alcohol abuse, poverty, and social isolation are related to homicides.^{2,3,4} A majority of homicides involve guns, and one study suggests that gun ownership increases your risk of being a victim of homicide in the home.⁵

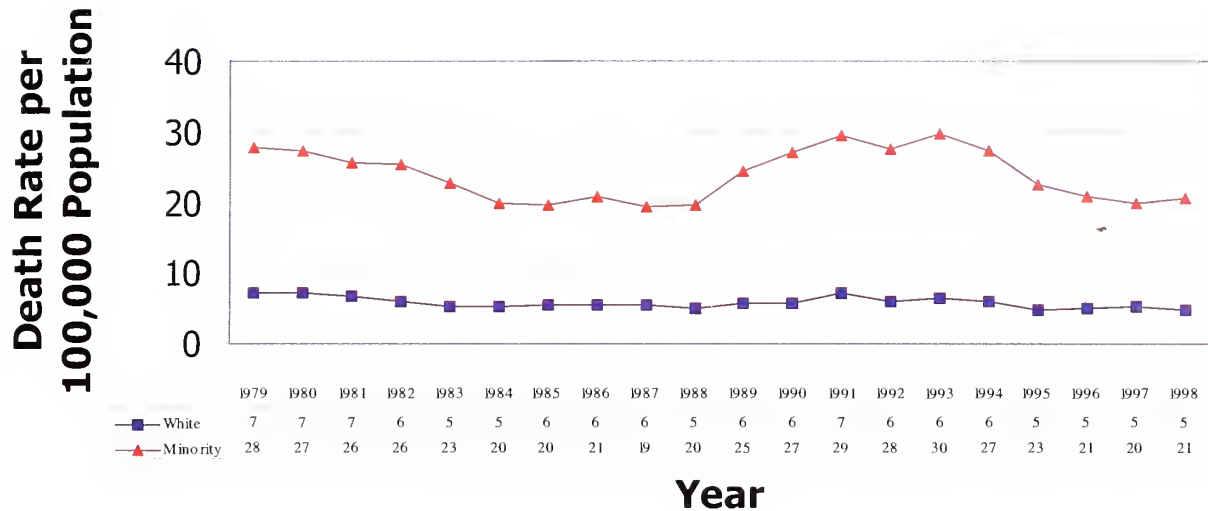
Geographic Patterns

Maps depicting unadjusted and age-adjusted homicide rates are presented in Figures 19.C and 19.D. Higher unadjusted and age-adjusted homicide mortality rates cluster in the south central and the northeastern portions of the state. This may be related to the racial composition of these areas.

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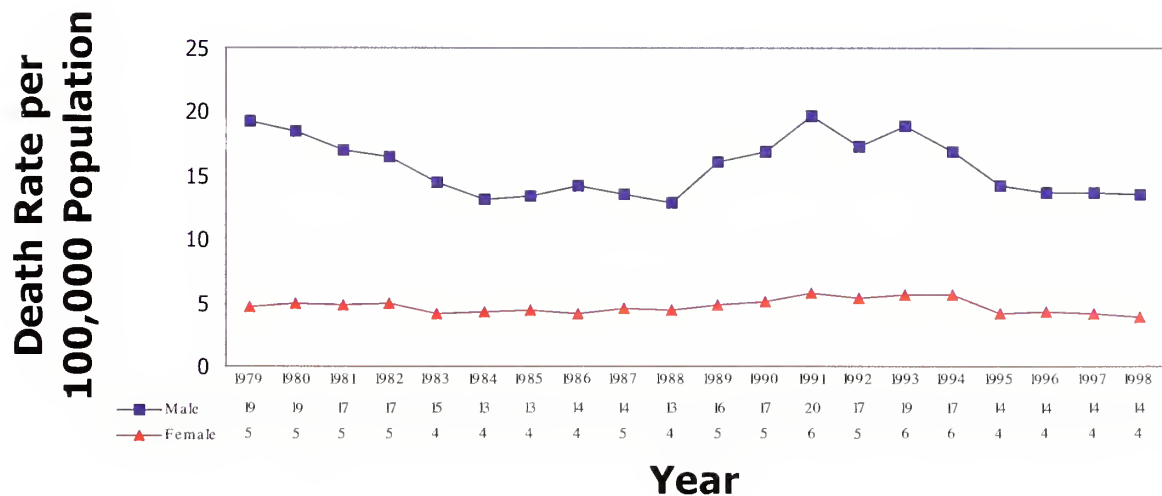
**Homicide:
North Carolina Resident
Age-Adjusted* Death Rates by Race 1979-1998**



*U.S. 2000 standard population

Figure 19.A

**Homicide:
North Carolina Resident
Age-Adjusted* Death Rates by Sex 1979-1998**



*U.S. 2000 standard population

Figure 19.B

TABLE 19
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Homicide

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
North Carolina	664	8.8	3,505	9.6	10.7	8.7	11.4	9.3
1 Alamance	10	8.2	41	7.0	12.2	7.6	10.4	7.0
2 Alexander	3	9.4	14	9.1	11.1	2.0	8.3	9.0
3 Alleghany	0	0.0	2	4.1	5.9	2.5	5.5	4.8
4 Anson	4	16.7	22	18.4	17.7	19.5	26.9	19.4
5 Ashe	2	8.4	5	4.3	5.5	1.0	8.5	4.0
6 Avery	1	6.5	4	5.2	8.6	1.2	5.6	5.2
7 Beaufort	6	13.8	22	10.2	13.7	9.5	10.1	10.6
8 Bertie	1	5.0	18	17.7	13.0	8.2	10.7	18.4
9 Bladen	4	13.0	19	12.6	19.4	11.9	16.5	12.8
10 Brunswick	9	13.4	33	10.5	7.5	11.5	8.3	10.6
11 Buncombe	9	4.7	73	7.7	8.1	7.0	7.4	7.8
12 Burke	8	9.5	28	6.8	10.7	7.7	8.2	6.8
13 Cabarrus	9	7.5	34	6.0	8.6	7.0	7.8	6.0
14 Caldwell	2	2.7	30	8.1	10.8	7.2	11.2	7.7
15 Camden	0	0.0	1	3.2	2.7	11.7	3.0	3.7
16 Carteret	2	3.4	17	5.8	9.8	3.8	5.3	6.0
17 Caswell	1	4.5	17	15.7	11.1	5.0	7.4	15.3
18 Catawba	7	5.3	46	7.2	9.5	6.5	10.1	7.1
19 Chatham	6	13.1	27	12.3	12.8	13.1	11.1	12.7
20 Cherokee	2	8.8	9	8.1	7.8	4.7	7.7	7.9
21 Chowan	1	7.0	4	5.7	8.5	12.9	9.3	6.4
22 Clay	0	0.0	3	7.6	12.2	2.5	0.0	8.4
23 Cleveland	7	7.6	55	12.2	12.7	10.5	18.8	12.5
24 Columbus	12	23.0	37	14.3	14.8	9.5	20.2	14.6
25 Craven	9	10.1	38	8.7	10.8	8.8	6.3	8.4
26 Cumberland	36	12.3	212	14.4	12.1	11.6	16.0	13.3
27 Currituck	0	0.0	2	2.5	11.5	7.7	4.1	2.2
28 Dare	1	3.6	4	3.0	6.1	4.0	5.6	2.9
29 Davidson	9	6.4	37	5.3	8.5	7.5	8.3	5.3
30 Davie	1	3.1	8	5.2	5.4	5.0	7.7	5.6
31 Duplin	8	18.1	34	15.7	12.1	6.0	18.9	16.0
32 Durham	35	17.4	173	17.7	13.5	12.2	13.1	15.6
33 Edgecombe	10	18.3	43	15.4	14.7	12.0	20.5	15.6
34 Forsyth	22	7.6	135	9.5	8.4	10.0	11.7	9.3
35 Franklin	3	6.8	28	13.2	22.0	15.0	11.1	13.2
36 Gaston	18	9.9	117	13.0	11.9	8.8	12.5	12.9
37 Gates	1	10.0	1	2.0	4.2	12.4	4.5	1.9
38 Graham	1	13.4	6	16.0	2.5	9.2	13.6	15.7
39 Granville	4	9.0	14	6.6	9.2	12.7	15.1	6.2
40 Greene	0	0.0	7	8.1	11.0	7.2	8.1	8.3
41 Guilford	36	9.3	205	10.9	9.7	8.5	11.2	10.4
42 Halifax	9	16.2	42	14.9	9.6	11.2	11.6	15.4
43 Harnett	10	12.0	52	13.1	18.8	11.1	14.3	12.7
44 Haywood	0	0.0	8	3.2	3.3	4.3	7.3	3.0
45 Henderson	2	2.5	12	3.1	6.7	6.7	7.2	2.9
46 Hertford	1	4.6	8	7.2	8.9	9.3	15.9	7.2
47 Hoke	4	13.3	23	16.3	12.5	6.5	20.4	15.3
48 Hyde	0	0.0	2	7.5	11.9	9.8	22.5	7.3
49 Iredell	10	8.8	46	8.6	8.8	9.5	11.9	8.5
50 Jackson	2	6.8	7	4.8	10.6	5.4	6.4	4.9

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 19 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Homicide

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS		AGE-ADJUSTED DEATH RATES*			
	Number	Rate*	Number	Rate*	1979-1983	1984-1988	1989-1993	1994-1998
51 Johnston	6	5.6	36	7.2	13.2	10.5	13.5	7.2
52 Jones	0	0.0	3	6.4	5.0	6.1	18.2	7.1
53 Lee	6	12.3	29	12.3	10.2	8.7	18.4	12.5
54 Lenoir	4	6.8	34	11.5	13.8	9.2	18.0	11.8
55 Lincoln	1	1.7	11	3.9	9.7	5.9	7.2	3.9
56 McDowell	4	10.0	15	7.8	3.9	9.9	5.8	7.7
57 Macon	0	0.0	3	2.2	2.1	4.1	5.9	1.6
58 Madison	1	5.3	3	3.3	16.2	10.4	4.4	3.1
59 Martin	1	3.9	10	7.8	8.9	8.5	17.1	7.8
60 Mecklenburg	65	10.4	367	12.4	13.6	11.5	18.7	11.7
61 Mitchell	0	0.0	1	1.4	1.8	4.7	2.7	1.5
62 Montgomery	2	8.1	10	8.3	18.8	10.0	13.8	8.4
63 Moore	5	7.1	24	7.1	10.7	8.0	8.5	7.8
64 Nash	7	7.9	38	8.9	15.7	10.3	13.2	8.7
65 New Hanover	12	8.1	46	6.5	8.9	7.6	7.1	6.1
66 Northampton	2	9.6	16	15.4	14.3	14.2	7.9	15.4
67 Onslow	4	2.7	30	4.0	7.2	5.4	5.9	3.3
68 Orange	6	5.5	27	5.1	8.1	7.5	6.4	4.8
69 Pamlico	2	16.5	3	5.0	3.5	3.9	6.1	5.7
70 Pasquotank	2	5.8	5	2.9	8.8	6.4	10.8	3.2
71 Pender	4	10.5	12	6.7	6.4	15.0	8.2	6.8
72 Perquimans	0	0.0	4	7.4	11.3	1.9	19.5	6.9
73 Person	2	6.0	7	4.3	12.4	7.6	7.5	4.3
74 Pitt	12	9.5	59	9.8	10.4	5.8	13.5	9.3
75 Polk	0	0.0	5	6.2	17.7	7.6	6.2	8.2
76 Randolph	5	4.0	36	6.1	7.8	8.1	8.1	6.0
77 Richmond	6	13.2	45	19.8	20.4	13.1	21.0	20.1
78 Robeson	31	27.1	135	24.1	18.9	18.1	20.0	24.2
79 Rockingham	10	11.2	36	8.1	10.4	7.4	10.6	8.3
80 Rowan	13	10.4	48	7.9	9.3	6.4	10.5	7.9
81 Rutherford	5	8.3	29	9.8	9.9	9.4	10.8	10.0
82 Sampson	8	15.0	44	17.1	13.4	8.7	13.7	17.6
83 Scotland	7	19.9	35	20.0	9.3	16.5	15.4	19.7
84 Stanly	6	10.8	25	9.2	5.7	5.0	7.4	9.2
85 Stokes	3	6.9	16	7.6	6.8	6.3	4.2	7.4
86 Surry	3	4.4	14	4.2	6.2	4.7	6.2	4.4
87 Swain	4	32.9	6	10.2	21.1	11.4	8.8	11.1
88 Transylvania	1	3.5	3	2.2	4.9	4.6	6.7	2.6
89 Tyrrell	0	0.0	0	0.0	23.4	9.2	0.0	0.0
90 Union	10	9.1	47	9.2	5.9	5.7	9.7	9.1
91 Vance	7	16.8	33	16.2	14.0	12.0	18.2	16.2
92 Wake	33	5.7	173	6.4	8.9	6.3	5.9	6.0
93 Warren	2	10.6	4	4.4	25.3	2.6	17.0	5.1
94 Washington	0	0.0	3	4.4	7.3	7.7	8.5	4.7
95 Watauga	0	0.0	4	2.0	3.9	2.0	4.5	2.4
96 Wayne	10	8.8	67	12.0	14.6	11.4	15.1	11.5
97 Wilkes	2	3.2	19	6.1	8.4	9.0	8.5	6.0
98 Wilson	11	15.9	53	15.5	15.7	13.2	18.8	15.6
99 Yadkin	1	2.8	3	1.7	4.0	2.6	3.1	1.8
100 Yancey	0	0.0	4	4.9	5.5	3.4	7.3	5.4

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Homicide

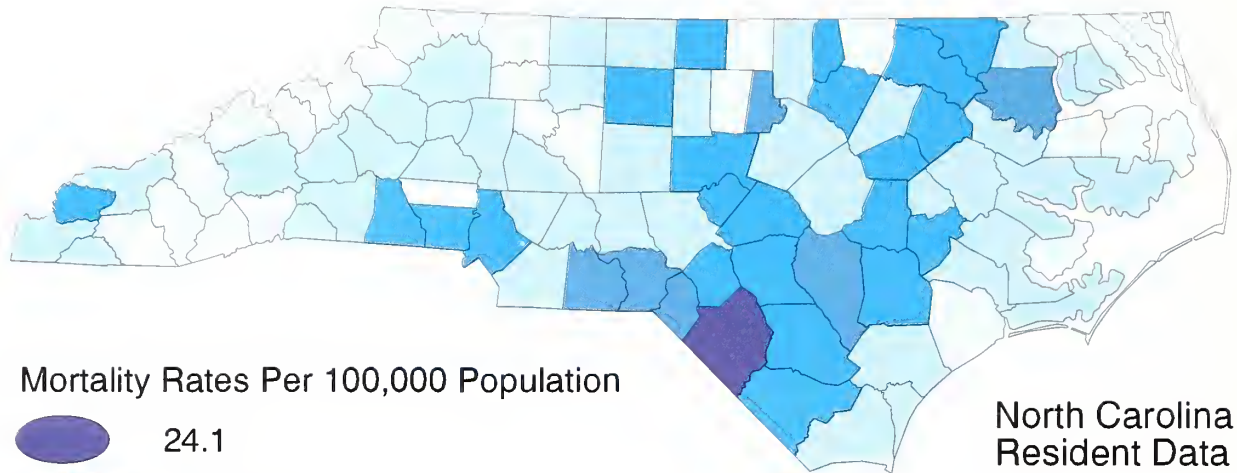


Figure 19.C

Homicide

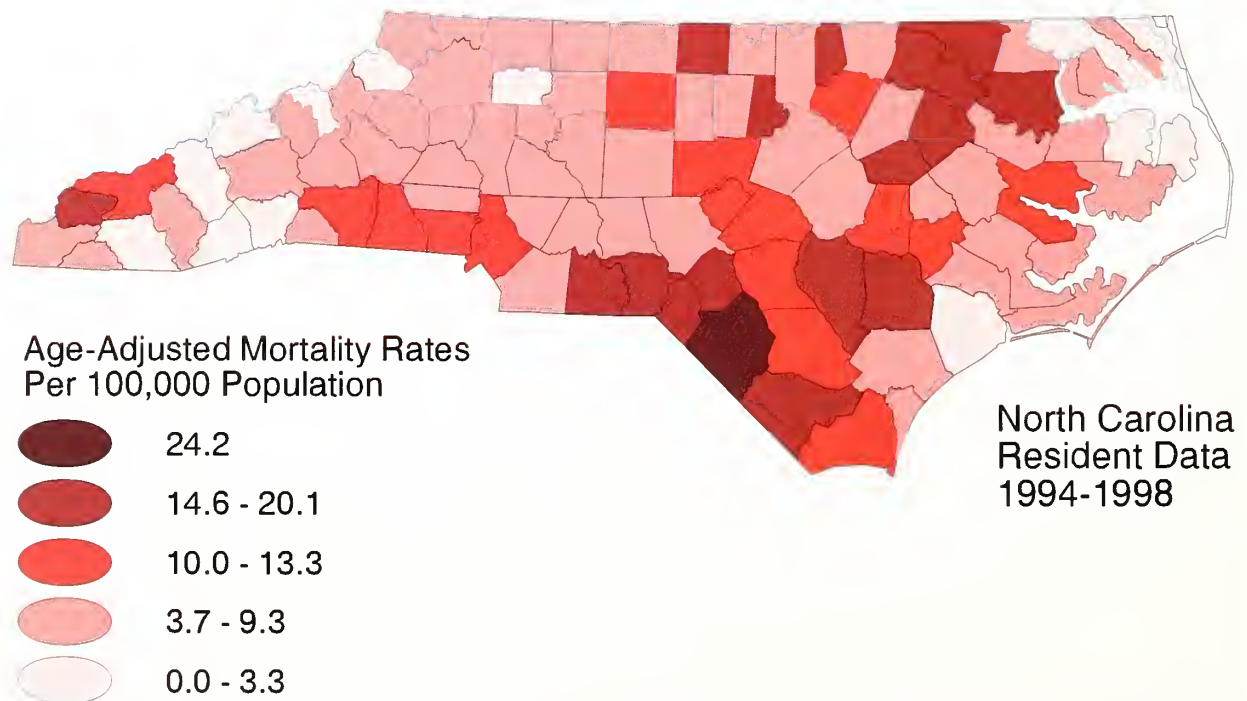


Figure 19.D

Infant Mortality

Introduction

Unlike other causes of death listed in this report, infant mortality (defined as death within the first year of life) includes deaths from all causes. Birth defects and complications related to preterm birth/low birth weight account for the vast majority of infant deaths in North Carolina. Although the infant mortality rate is not age-adjusted, it is often partitioned into two components: 1) neonatal mortality, which includes deaths under 28 days of age; and 2) postneonatal mortality, which includes deaths from 28 to 365 days of age.

In 1998 there were 1,037 infant deaths to North Carolina residents, accounting for 1.5 percent of all resident deaths in the state. Approximately 70 percent (n=723) of the infant deaths were among neonates, with the remaining 30 percent occurring during the postneonatal period. The overall infant mortality rate in 1998 was 9.3 deaths per 1,000 live births. The provisional 1998 United States rate was 7.0.¹

Differentials and Trends

Since 1979 North Carolina's infant mortality rate has declined by almost 39 percent, from 15.2 to 9.3. About 60 percent of this decline occurred between 1979 and 1986. This was a period during which advancements in neonatal intensive care and the continuing development of the state's regionalized perinatal program led to substantial improvements in the survival of low birth weight infants and other critically ill newborns.²⁻⁴ In 1988, North Carolina's infant mortality rate of 12.6 placed the state 49th in the United States in infant mortality, prompting a concerted effort to improve services for pregnant women such as prenatal care and enhanced Medicaid coverage to 185 percent of the poverty level.⁵ Although the infant mortality rate continued a general pattern of decline over the next several years, since 1995 there has been no improvement in the rate in North Carolina while the United States infant mortality rate has continued a downward trend.⁶ A major factor contributing to the lack of improvement in North Carolina's infant mortality rate is the increasing rate of very preterm births, which has been on the rise since the late 1980's.

Risk Factors

Because infant mortality is often considered to be a barometer of the general health and well-being of a population, discussion of the major risk factors frequently focuses on socioeconomic indicators such as poverty, low education, young maternal age, and unintended pregnancy. In fact, the strongest direct risk factors for infant death are maternal medical conditions such as infection, hypertension, and diabetes; obstetrical complications such as vaginal bleeding, poor weight gain, and multiple gestation; and previous pregnancy history, including prior fetal or infant death. With disadvantaged populations tending to be at increased risk for many of these conditions, and to have generally poorer health status overall compared to other groups, the link between infant mortality and low socioeconomic status is clear.

A more perplexing issue is the association between race and infant mortality. Minority populations, and African Americans in particular, often experience infant mortality rates that are more than twice that of whites.⁶ Over the past twenty years the black-white disparity in infant mortality

has continued to increase and has grown to a 2.5-fold difference in 1998 (Figure 20.A). While poverty and other socioeconomic factors clearly play an important role in the high minority infant mortality rate, the fact that the racial disparity persists even after controlling for these factors suggests that the problem is considerably more complex than can be explained by poverty alone.⁷⁻⁹

Geographic Patterns

County infant mortality rates tend to be highest in the northeastern coastal plain (Figure 20.C). This pattern is due largely to the higher proportion of births to minorities in these counties, combined with the high rate of infant death among these groups as discussed above. Other issues, such as limited access to prenatal care and other preventive health services, may play a role in the high infant mortality rates in this predominantly rural region of the state.

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Infant Mortality Rates by Race 1979-1998

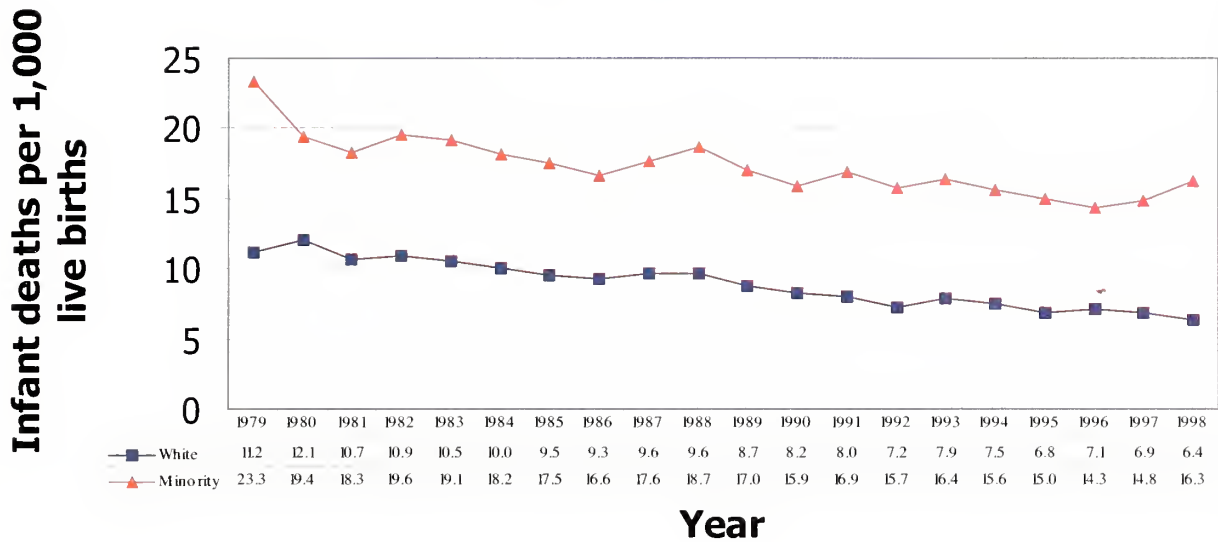


Figure 20.A

Infant Mortality Rates by Sex 1979-1998

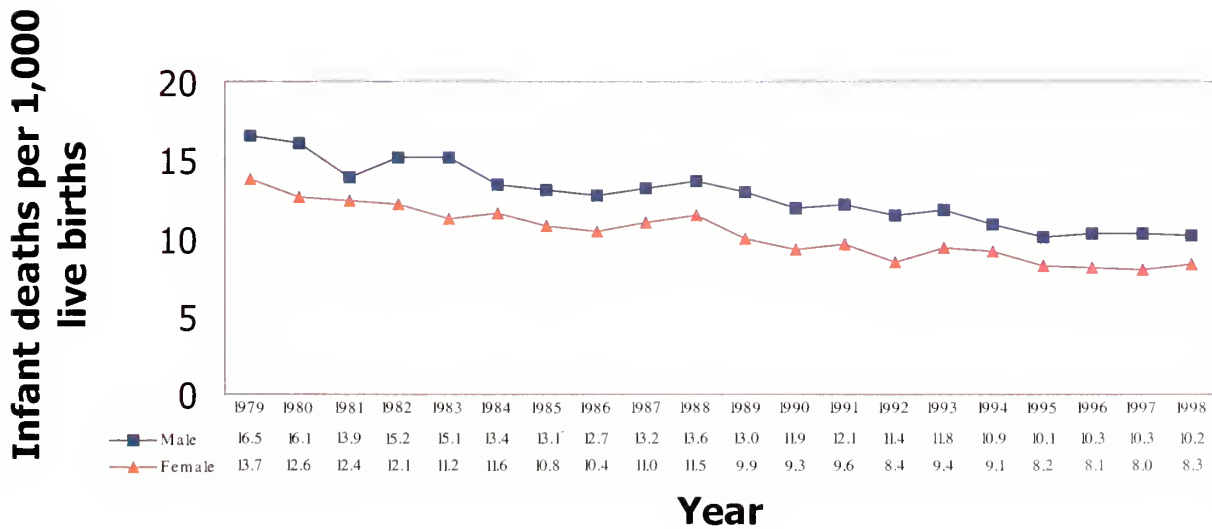


Figure 20.B

TABLE 20
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Infant Deaths (Per 1,000 Live Births)

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS	
	Number	Rate*	Number	Rate*98
North Carolina	1,037	9.3	4,933	9.4
1 Alamance	18	10.9	69	8.8
2 Alexander	5	11.8	20	10.0
3 Alleghany	1	9.1	1	2.1
4 Anson	7	20.6	19	11.4
5 Ashe	3	12.7	14	11.6
6 Avery	2	11.6	11	12.4
7 Beaufort	11	18.7	36	12.9
8 Bertie	3	12.5	13	9.5
9 Bladen	4	8.5	22	10.3
10 Brunswick	4	5.2	20	5.4
11 Buncombe	15	6.0	91	7.9
12 Burke	9	7.8	55	10.0
13 Cabarrus	12	6.7	43	5.4
14 Caldwell	5	4.6	42	8.6
15 Camden	3	75.0	5	18.5
16 Carteret	4	6.4	24	7.8
17 Caswell	8	31.6	19	15.8
18 Catawba	13	6.9	54	6.2
19 Chatham	7	10.5	32	10.9
20 Cherokee	5	19.2	14	11.2
21 Chowan	6	25.4	9	8.8
22 Clay	3	45.5	3	8.9
23 Cleveland	9	6.7	57	8.9
24 Columbus	10	12.2	43	11.3
25 Craven	14	8.8	58	7.6
26 Cumberland	66	11.7	292	10.4
27 Currituck	4	21.4	15	16.9
28 Dare	2	6.4	6	4.0
29 Davidson	18	9.8	67	7.5
30 Davie	1	2.5	13	7.1
31 Duplin	6	8.0	39	11.0
32 Durham	39	11.9	158	10.2
33 Edgecombe	10	12.2	40	9.3
34 Forsyth	40	9.2	256	12.4
35 Franklin	5	8.6	22	7.9
36 Gaston	24	9.5	113	9.0
37 Gates	2	18.0	4	7.3
38 Graham	0	0.0	1	2.1
39 Granville	3	5.1	30	10.8
40 Greene	4	13.4	17	14.9
41 Guilford	47	8.4	260	9.9
42 Halifax	12	16.3	60	15.5
43 Harnett	12	8.6	63	9.5
44 Haywood	6	11.5	24	9.0
45 Henderson	10	10.0	43	9.9
46 Hertford	5	17.2	22	15.2
47 Hoke	6	9.3	30	11.0
48 Hyde	0	0.0	3	10.7
49 Iredell	15	9.1	70	9.4
50 Jackson	2	6.0	14	8.9

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

TABLE 20 (cont.)
1998 NORTH CAROLINA RESIDENT MORTALITY STATISTICS:
Infant Deaths (Per 1,000 Live Births)

GEOGRAPHIC AREA	1998 DEATHS		1994-98 DEATHS	
	Number	Rate*	Number	Rate*
51 Johnston	16	8.6	73	9.0
52 Jones	1	8.9	7	13.6
53 Lee	7	8.3	42	11.3
54 Lenoir	9	10.4	55	12.8
55 Lincoln	6	7.5	28	7.3
56 McDowell	2	3.9	23	9.7
57 Macon	1	3.4	11	7.9
58 Madison	1	4.2	11	10.2
59 Martin	7	18.9	19	11.5
60 Mecklenburg	75	7.1	335	7.1
61 Mitchell	1	6.4	6	7.7
62 Montgomery	3	6.8	18	9.3
63 Moore	13	13.6	48	11.3
64 Nash	20	17.1	81	13.7
65 New Hanover	12	6.3	62	6.7
66 Northampton	5	19.0	23	17.8
67 Onslow	21	6.6	131	8.2
68 Orange	18	15.5	53	9.3
69 Pamlico	0	0.0	4	6.8
70 Pasquotank	12	25.9	37	17.0
71 Pender	2	4.6	9	4.1
72 Perquimans	2	18.0	9	16.0
73 Person	5	11.5	24	11.3
74 Pitt	21	11.0	121	13.6
75 Polk	4	22.7	13	16.0
76 Randolph	12	6.8	57	6.9
77 Richmond	8	11.4	39	11.6
78 Robeson	23	10.9	118	12.0
79 Rockingham	10	8.4	56	9.8
80 Rowan	12	7.1	72	9.3
81 Rutherford	3	3.8	31	7.8
82 Sampson	7	8.1	37	9.5
83 Scotland	6	10.4	31	11.0
84 Stanly	9	12.5	32	9.1
85 Stokes	2	3.7	20	7.8
86 Surry	6	6.3	34	7.7
87 Swain	0	0.0	5	6.0
88 Transylvania	3	10.6	19	13.6
89 Tyrrell	2	46.5	4	21.9
90 Union	16	8.5	71	8.2
91 Vance	8	12.0	48	15.0
92 Wake	82	9.1	350	8.5
93 Warren	2	9.2	7	7.0
94 Washington	2	12.6	13	13.9
95 Watauga	4	11.9	16	9.0
96 Wayne	18	10.5	79	9.7
97 Wilkes	6	7.3	33	8.3
98 Wilson	11	9.5	60	11.6
99 Yadkin	1	1.9	18	7.9
100 Yancey	0	0.0	4	4.6

*Death rates with a small number of deaths in the numerator should be interpreted with caution. SEE TECHNICAL NOTES.

Infant Deaths

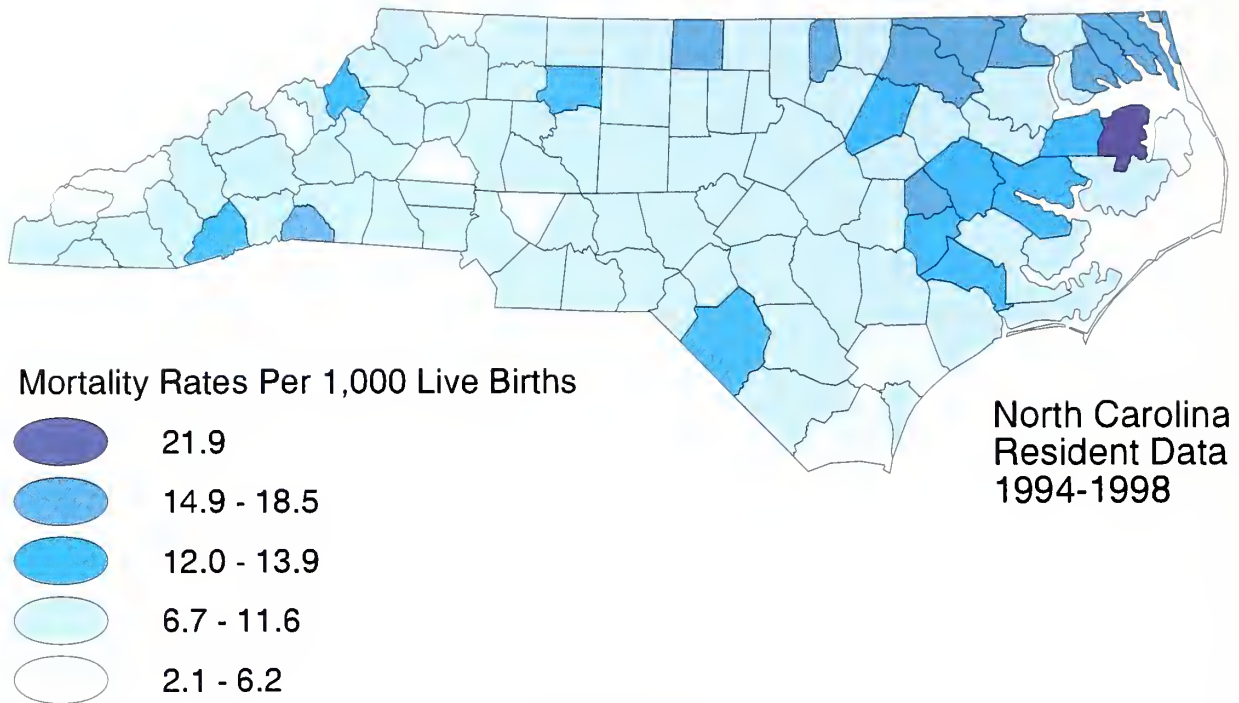


Figure 20.C

TECHNICAL NOTES

Computation of Death Rates

In this report, total mortality rates are expressed as resident deaths per 1,000 population. All cause-specific death rates are expressed as resident deaths per 100,000 population. Deaths are assigned to cause-of-death categories based on the underlying (or primary) cause of death from the death certificate. Appendix A describes the cause-of-death categories in terms of codes from the ninth revision of the International Classification of Diseases. All rates in Tables 1-19 use total population in the denominator except rates for the sex-specific cancer sites use male or female population in the denominator. Population bases for these rates were provided by the Office of State Planning in the Governor's Office. The infant mortality rates in Table 20 and Figures 20.A-20.C are computed as the number of resident deaths under one year of age per 1,000 resident live births.

Deaths in this report are assigned to place of residence. For deaths of people in long-term institutions (mental, penal, old age, orphan, nursing home, rest home, etc.), the institution is considered the usual residence if the decedent lived in the institution at least one year. College students and military personnel are considered residents of the college or military community.

The following definitions apply to the rates of this report:

Unadjusted Annual Death Rate: The annual death rates are computed as resident deaths per 1,000 or 100,000 population. These rates reflect an area's status according to the deaths during the given year.

Unadjusted 5-Year Death Rate: The average annual death rates are computed as average resident deaths per 1,000 or 100,000 average population. These multi-year rates are computed by summing the deaths for the five years, summing the population for the five years, dividing the former by the latter, and then multiplying the result by a constant (1,000 or 100,000). These rates give an area's status with respect to the deaths during the 5-year period and are shown in the first set of maps (e.g. Figures 1.C, 2.C).

Adjusted 5-Year Death Rate: The average annual age-adjusted rates are computed by the direct method. These rates are also expressed as deaths per 1,000 or 100,000 population and represent the rate that would be expected if the age composition of the state and each county's population were the same as that projected for the nation in the year 2000. However, the user should not compare an adjusted death rate to an unadjusted death rate. Also, adjusted rates for different time periods cannot be directly compared unless they were adjusted by the same standard population.

The age-adjusted rates in this 1998 edition of *Leading Causes of Death* involve a significant change from past editions. While the 1996-97 editions of this publication used the 1990 North Carolina population as a standard, this year the age-adjusted deaths rates are standardized using the projected United States 2000 population. **Therefore, the adjusted rates in this 1998 edition are not comparable to those in previous editions.** With this in mind, the 1998 edition includes five-year age-adjusted death rates, using the United States 2000 standard population, over a twenty year period (1979-1988) to allow for comparisons of the adjusted death rates over time. However, the second set of maps includes only the 1994-98 age-adjusted death rates (e.g., Figures 1.D, 2.D).

We have changed the standard population again to be consistent with the new practices of the National Center for Health Statistics. This will allow in the future direct comparisons of the state and county age-adjusted death rates for North Carolina to the published United States age-adjusted death rates.

In age-adjusting the death rates in this publication, 10 age groups are used to compute age-specific death rates for each geographic area and cause of death. These rates are then applied to the 2000 United States standard population by age: 0-4, 5-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84, and 85+. For details of the age adjustment process, refer to the Statistical Primer on age-adjusted rates in Appendix D.

For the maps, a clustering routine from the Statistical Analysis System (SAS) was used to group counties that are "most like each other" with respect to their unadjusted and their adjusted rate. These maps show five levels of death rates, where level one is the lowest rate interval and level five the highest.

A word of caution: Rates for sex-specific cancers (e.g., prostate) use male or female population in the denominator and therefore are not comparable to other rates. Therefore, in ranking the causes of cancer death by site one must use the observed number of deaths rather than the rates.

Interpretation of Death Rates

To assess a county's relative mortality during a 5-year period, both the unadjusted and the adjusted rate can be compared to the corresponding state rates for a particular cause of death. This, of course, should not be done if the county's unadjusted rate has fluctuated widely in recent years. The rate should represent a relatively stable situation. Then, the following alternative interpretations will apply:

Relative Status Of Unadjusted Rate	Adjusted Rate	Interpretation of Unadjusted Rate
Low	Low	Low mortality is not due to age, other mortality conditions are favorable.
Low	High	Low mortality is due to favorable age distribution, other mortality conditions are unfavorable.
High	Low	High mortality is due to unfavorable age distribution, other mortality conditions are favorable.
High	High	High mortality is not due to age, other mortality conditions are unfavorable.

Caution: In assessing the relative mortality of a county, be particularly aware of rates based on a small number of deaths (fewer than 20 deaths). In such cases, random fluctuation in the rate may render rate comparisons risky. The reader should read very carefully the next section entitled "Caution About Use of Rates."

Caution About Use of Rates

Small Number of Events:

Any death rate with a small number of deaths in the numerator will have substantial random variation over time (a large standard error). A good rule of thumb is that any rate based on fewer than 20 events in the numerator may be subject to serious random error. As such, extreme caution should be taken when making comparisons or assessing trends with rates calculated with fewer than 20 events. Many of the death rates in this report have numerators smaller than 20. For a detailed discussion of Problems with Rates Based on Small Numbers, refer to Statistical Primer No. 12 of the State Center for Health Statistics, available on our Web site (www.schs.state.nc.us/SCHS/) or by request to the Information Services Unit.

Adjusted Death Rates:

Unadjusted death rates are affected by the demographic composition of populations. As such, differences in demographic composition from one geographic area to another or from one point in time to another may hinder comparisons. The standardized adjustment of rates addresses this problem. The adjusted rate is a hypothetical rate computed in a way that reflects what the death rate would be in a particular geographic area, if the geographic area had the same age composition of the standard population. The measure, while useful for comparative purposes across time and geographic area, has no observable or descriptive value in and of itself. The adjusted rate provides opportunities for comparisons across time and geographic area as long as all rates that are to be compared share the same population standard and are adjusted for the same demographic categories.

Small Subpopulations:

As discussed above, adjusted rates in this 1998 edition of the *Leading Causes of Death* represent a change from previous editions. While the 1996 and 1997 editions used the 1990 North Carolina population as the standard in calculating age-adjusted death rates, the age-adjusted death rates in the 1998 edition are based on a projected United States 2000 population standard. Since the adjusted rates in this edition are not comparable to rates in earlier editions of this publication, five-year age-adjusted rates from 1979 through 1998 are included in each cause-of-death table so that the rates can be compared over time.

Beginning with the 1996 edition of *Leading Causes of Death*, age-adjusted rates rather than age-race-sex adjusted rates have been presented. This change was made because small age-race-sex populations may produce unstable age-race-sex adjusted rates. One death out of an estimated population of five, for example, would produce a death rate of 20,000 per 100,000 population. If this rate were applied to the appropriate age-race-sex group of the standard population, a very large number of expected deaths would result and the adjusted rate would be extremely high. On the other hand, zero deaths in several population groups may result in a very low age-race-sex adjusted rate.

Counties with a very small minority population, predominantly in western North Carolina, are particularly subject to extreme age-race-sex-adjusted rates (high or low) due to small age-race-sex-specific population groups. For example, in the 1995 *Leading Causes of Death*, Macon County was shown as having a 1991-1995 age-race-sex adjusted death rate for breast cancer of 64.6 compared to the adjusted state rate of 28.3. Further investigation showed that this very high adjusted rate was due to two breast cancer deaths in a very small age 55-64 minority female population group. When the 1991-95 breast cancer death rate was adjusted only for age, the Macon County rate was 30.4 compared to a North Carolina age-adjusted rate (1980 standard) of 25.6. Unusually high or low rates, therefore, may be biased due to small numbers. To eliminate these problems, the 1996 and subsequent editions of this publication report only age-adjusted rates. By dividing the deaths and population into 10 age groups rather than 40 age-race-sex groups in order to calculate an adjusted rate, the adjusted rates will be much more stable statistically. Also, age generally has a much stronger impact on mortality than race or sex, and therefore is the most important factor to adjust for.

APPENDICES

APPENDIX A

List of Selected Causes of Death

(used for Tables I and J)

CAUSE OF DEATH	ICD-9 CODES*
Heart Disease	390-398,402,404-429
Cerebrovascular Disease	430-438
Atherosclerosis	440
Cancer	140-208
Lip, Oral Cavity, and Pharynx	140-149
Stomach	151
Colon, Rectum, and Anus.....	153,154
Liver	155
Pancreas	157
Larynx	161
Trachea, Bronchus, and Lung	162
Malignant Melanoma	172
Female Breast	174
Cervix Uteri	180
Ovary and Other Uterine Adnexa	183
Prostate	185
Bladder	188
Brain Tumors	191
Non-Hodgkins Lymphoma	200,202
Leukemia	204-208
Acquired Immune Deficiency Syndrome	042-044
Septicemia	038
Diabetes Mellitus	250
Pneumonia and Influenza	480-487
Chronic Obstructive Pulmonary Disease and Allied Conditions.....	490-496
Chronic Liver Disease and Cirrhosis	571
Nephritis, Nephrotic Syndrome, and Nephrosis	580-589
Unintentional Motor Vehicle Injuries	E810-E825
All Other Unintentional Injuries and Adverse Effects.....	E800-E807,E826-E949
Suicide	E950-E959
Homicide.....	E960-E978

*International Classification of Diseases, Ninth Revision.

APPENDIX B

List of 43 Selected Causes of Death*

(used for Table E)

CAUSE OF DEATH	ICD-9 CODES**
Shigellosis and amoebiasis	004,006
Certain other intestinal infections	007-009
Tuberculosis	010-018
Whooping cough	033
Streptococcal sore throat, scarlatina, and erysipelas	034-035
Meningococcal infection	036
Septicemia	038
Human immunodeficiency virus infection (AIDS)	042-044
Acute poliomyelitis	045
Measles	055
Viral hepatitis	070
Syphilis	090-097
All other infectious and parasitic diseases	001-003,005,020-032,037,039-041,046-054,056-066,071-088,098-139
Malignant neoplasms, including neoplasms of lymphatic and haematopoietic tissues	140-208
Benign neoplasms, carcinoma in situ, and neoplasms of uncertain behavior and of unspecified nature	210-239
Diabetes mellitus	250
Nutritional deficiencies	260-269
Anemias	280-286
Meningitis	320-322
Heart disease	390-398,402,404-429
Hypertension with or without renal disease	401,403
Cerebrovascular disease	430-438
Atherosclerosis	440
Other diseases of arteries, arterioles, and capillaries	441-448
Acute bronchitis and bronchiolitis	466
Pneumonia and influenza	480-487
Chronic obstructive pulmonary diseases and allied conditions	490-496
Ulcer of stomach and duodenum	531-533
Appendicitis	540-543
Hernia of abdominal cavity and intestinal obstruction without mention of hernia	550-553,560
Chronic liver disease and cirrhosis	571
Cholelithiasis and other disorders of gallbladder	574-575
Nephritis, nephrotic syndrome, and nephrosis	580-589
Infections of kidney	590
Hyperplasia of prostate	600
Complications of pregnancy, childbirth, and the puerperium	630-676
Congenital anomalies	740-759
Certain conditions originating in the perinatal period	760-779
Symptoms, signs, and ill-defined conditions	780-799
Injuries and adverse effects	E800-E949
Suicide	E950-E959
Homicide and legal intervention	E960-E978
All other external causes	E980-E999

*List developed by the National Center for Health Statistics.

**International Classification of Diseases, Ninth Revision.

APPENDIX C

List of 27 Selected Causes of Infant Death*

(used for Table E, Ages <1)

CAUSE OF DEATH	ICD-9 CODES**
Certain intestinal infections	008-009
Whooping cough	033
Meningococcal infection	036
Septicemia	038
Viral diseases	045-079
Congenital syphilis	090
Remainder of infectious and parasitic diseases	001-007,010-032,034-035,037,039-041,080-088,091-139
Malignant neoplasms, including neoplasms of lymphatic and hematopoietic tissues	140-208
Benign neoplasms, carcinoma in situ, and neoplasms of uncertain behavior and of unspecified nature	210-239
Diseases of thymus gland	254
Cystic fibrosis	277.0
Diseases of blood and blood-forming organs	280-289
Meningitis	320-322
Other diseases of nervous system and sense organs	323-389
Acute upper respiratory infections	460-465
Bronchitis and bronchiolitis	466,490-491
Pneumonia and influenza	480-487
Remainder of diseases of respiratory system	470-478,492-519
Hernia of abdominal cavity and intestinal obstruction without mention of hernia	550-553,560
Gastritis, duodenitis, and noninfective enteritis and colitis	535,555-558
Remainder of diseases of digestive system	520-534,536-543,562-579
Congenital anomalies	740-759
Certain conditions originating in the perinatal period	760-779
Symptoms, signs, and ill-defined conditions	780-799
Accidents and adverse effects	E800-E949
Homicide	E960-E969
All other causes	Residual

*List developed by the National Center for Health Statistics.

**International Classification of Diseases, Ninth Revision.



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STATISTICAL PRIMER

No. 13

August 1998

Age-Adjusted Death Rates

by

Paul A. Buescher

Introduction

Mortality or death rates are often used as measures of health status for a population. Population-based incidence or morbidity data are available in North Carolina in a few areas such as cancer and certain communicable diseases, but for most chronic diseases we know only how many people died from the disease and not how many are living with it. Given the importance of data from death certificates in measuring the health of populations, it is important that valid comparisons of death rates are made. Many factors affect the risk of death, including age, race, gender, occupation, education, and income. By far the strongest of these factors affecting the risk of death is age. Populations often differ in age composition. A “young” population has a higher proportion of persons in the younger age groups, while an “old” population has a higher proportion in the older age groups. Therefore, it is often important to control for differences among the age distributions of populations when making comparisons among death rates to assess the relative risk of death. This Statistical Primer describes how age-adjusted death rates are calculated and discusses some related issues.

The methods for adjusting death rates for age that are shown here could also be applied to other characteristics of a population, such as income or gender, if it were considered desirable to adjust for such characteristics before comparing death rates. Also, disease incidence rates, birth rates, or other types of rates could be adjusted for age, or other factors, using the general approach presented here.



Crude and Age-specific Death Rates

A crude or unadjusted death rate is simply the number of deaths divided by the population at risk, often multiplied by some constant so that the result is not a fraction. For example, for Hertford County, North Carolina during the period 1991 through 1995, there were 1,336 deaths to residents of the county. To get an annualized death rate for this five-year period, the estimated mid-year resident population is summed over the five years. For Hertford County, the sum of the population of those five years is 112,419. The crude death rate is 1,336 divided by 112,419 which equals .01188. This is the average annual proportion who died during the period 1991-95 (slightly more than one percent). When multiplied by 1,000, which is a common multiplier for a death rate for all causes of death, the rate is 11.9 deaths per 1,000 population per year (see last row of Table 1). For death rates for specific causes of death, a multiplier of 100,000 is often used so that the rate is not less than 1.0. For smaller geographic areas or when using cause-specific death rates, it is often desirable to calculate multi-year death rates to decrease random variation in the rates due to small numbers of deaths in a single year. These multi-year death rates are essentially average annual rates.

Table 1
Age-Specific Death Rates for All Causes of Death
Hertford County, North Carolina Residents
1991-1995 Combined

Age Group	1 Number of 1991-95 Deaths	2 Sum of 1991-95 Population	3 Percentage of Population by Age	4 Age-Specific Death Rates Proportion Who Died	5 Per 1,000 Population
0-4	30	8,150	7.3	.00368	3.68
5-14	2	17,109	15.2	.00012	0.12
15-24	24	16,601	14.8	.00145	1.45
25-34	34	14,872	13.2	.00229	2.29
35-44	59	16,199	14.4	.00364	3.64
45-54	85	12,381	11.0	.00687	6.87
55-64	147	10,277	9.2	.01430	14.30
65-74	305	9,370	8.3	.03255	32.55
75-84	406	5,631	5.0	.07210	72.10
85+	244	1,829	1.6	.13341	133.41
Total	1,336	112,419	100.0	.01188	11.9

The crude death rate is a good measure of the overall magnitude of mortality in a population. If a population is old and has a high mortality rate as a result, then the crude rate is useful information for some purposes, such as planning for the delivery of health care services.

An age-specific death rate is simply a crude death rate for a specific age group. One can also calculate rates specific for race, gender, or other factors. Table 1 shows age-specific death rates

for Hertford County residents for the period 1991-95, with ten commonly-used age groupings. Note that the death rate for ages 0-4 is substantially higher than the death rates for the other younger age groups (primarily due to a high death rate during infancy); only at ages 45-54 does the death rate exceed that for ages 0-4. It can be immediately seen that the death rates are many times higher in the oldest age groups. Therefore, a geographic area or demographic group with an older population will automatically have a higher overall death rate just because of the age distribution. The main purpose of age-adjusting death rates is to control for differences in the age distribution of various populations before making mortality comparisons.

For some causes of death, such as injuries and AIDS, older persons do not have the highest death rates. But even in these cases it is important to standardize for age when comparing death rates across different populations, since some populations may have a higher proportion of persons in the age groups with the highest death rates.

Another Statistical Primer by the State Center for Health Statistics discusses the issue of random error in vital rates and presents formulas for quantifying this error and calculating confidence intervals around the measured rates.¹ Those formulas are applicable to the crude and age-specific rates presented here, and to any simple or unadjusted rate. Random error may be substantial when a rate or percentage has a small number of events in the numerator (e.g. less than 20).

Age-adjusted Death Rates

Direct Method

The direct method of age adjustment is frequently used to compare the death rates of different populations, by controlling for differences in age distribution. The age-specific death rates of the population of interest (sometimes called the “study” population) are applied to the age distribution of a “standard” population in order to calculate “expected deaths.” These are the deaths that would occur in the standard population IF the age-specific rates of the study population were in operation. These expected deaths for each age group are then summed and divided by the total standard population to arrive at the age-adjusted death rate. Stated another way, this is the death rate that the study population would have IF it had the same age distribution as the standard population.

Table 2 provides an example. The age-specific death rates for all causes of death for Hertford County are applied to the 1980 North Carolina population by age, which is used as the standard. (Any population could be used as the standard; the 1980 North Carolina population was chosen somewhat arbitrarily for purposes of illustration.) To generate the expected deaths in column 4, the rates shown in column 1 are converted to a proportion by moving the decimal point three places to the left and then multiplied by the standard population groups by age in column 2. The total expected deaths are then divided by the total standard population and the result multiplied by 1,000 to yield an age-adjusted death rate for Hertford County of 8.7. Usually it would not be necessary to show the age-specific death rates to two decimal places (false precision), but in this case the extra digits are needed to get a more accurate estimate of the number of expected deaths.

Table 2
Age-Adjustment by the Direct Method
Hertford County, North Carolina Residents
1991-1995 Combined; All Causes of Death

Age Group	1 Hertford County 1991-95 Age-Specific Death Rate (per 1,000)	2 1980 N.C. Population (Standard)	3 Percentage of Standard Population By Age	4 Expected Deaths
0-4	3.68	404,560	6.9	1,489*
5-14	0.12	927,836	15.7	111
15-24	1.45	1,144,204	19.4	1,659
25-34	2.29	968,215	16.4	2,217
35-44	3.64	689,838	11.7	2,511
45-54	6.87	601,866	10.2	4,135
55-64	14.30	552,494	9.4	7,901
65-74	32.55	389,244	6.6	12,670
75-84	72.10	172,408	2.9	12,431
85+	133.41	45,956	0.8	6,131
Total	11.9 (Crude Rate)	5,896,621	100.0	51,255

$$\begin{aligned}
 &\text{Age-Adjusted} \\
 &\text{Death Rate} = (51,255 \div 5,896,621) \times 1,000 \\
 &= 8.7
 \end{aligned}$$

This adjusted death rate is considerably lower than the crude death rate of 11.9. This is mainly because the percentages in the age groups 65 and older are substantially lower in the 1980 North Carolina standard population (column 3 of Table 2) than the same percentages in the 1991-95 Hertford County population (column 3 of Table 1). When the Hertford County age-specific death rates are adjusted to a younger standard population, the overall adjusted rate is lower.

The crude death rate for North Carolina for the 1991-95 period for all causes of death was 8.9, compared to the crude rate of 11.9 for Hertford County. The 1991-95 North Carolina death rate adjusted to the 1980 North Carolina age distribution is 7.4, compared to the age-adjusted rate of 8.7 for Hertford County. The difference in the crude rates between North Carolina and Hertford County is larger partly because Hertford County had an older population. The fact that the age-adjusted rate for Hertford County is still higher than that for North Carolina suggests that the 1991-95 age-specific death rates for Hertford County were generally higher than those for the state in 1991-95.

Ten age groups are often used for age adjustment of death rates. This provides enough detail to capture differences in the age distributions of the populations that are being compared, but not so

many age categories that the data are “spread too thin.” For many years, the State Center for Health Statistics used 18 five-year age groups for age adjustment, but during the 1980’s changed to ten age groups because the 18 categories often resulted in the numerators of the age-specific rates being very small, leading to unstable rates.

An alternate formula for computing the age-adjusted death rate by the direct method is simply to sum the products of the age-specific death rate and the proportion of the standard population in that age group across all ten age groups. This weighted sum is represented by the following formula:

$$\text{Age-adjusted death rate} = \sum_{i=1}^{10} w_i p_i$$

where p_i is the age-specific mortality rate for age group i and w_i (or the weight) is the proportion of the standard population in age group i (move the decimal point of the percentages in column 3 of Table 2 two places to the left). The crude death rate can also be expressed as a weighted sum of the age-specific death rates and the proportions of the population by age, where the proportions in this case are simply the proportions of the study population itself in each age group (rather than the standard population). Try to reproduce the crude and age-adjusted death rates in Tables 1 and 2 using this weighted sum method! Any minor differences are due to rounding.

An age-adjusted death rate is a summary measure that condenses a lot of information into one figure. Where feasible, it is always desirable to inspect the age-specific death rates of the populations being compared. This additional detail often provides further insights into the nature of the mortality differences between the populations.

Indirect Method

The indirect method of age-adjustment applies the age-specific death rates of the standard population to the age distribution of the study population in order to generate expected deaths in the study population. These are the deaths that would occur in the study population IF the age-specific death rates in the standard population were in operation. This method may be used in situations where the numbers of deaths in each age group in the study population are too small to calculate stable age-specific rates. Also, this method is often used in developing countries or other areas where there is no information available on age-specific deaths for the study population, but there is such information available for a national or standard population. The expected deaths are then summed across the age groups and compared to the actual or observed number of deaths for the study population. This ratio of observed/expected deaths is often referred to as the **standardized mortality ratio**, or SMR. A ratio greater than 1.0 indicates higher mortality in the study population compared to the standard population (controlling for age distribution), while a ratio less than 1.0 indicates lower mortality in the study population. The SMR controls for age distribution since both the observed and expected deaths are based on the age distribution of the study population. Multiplying the SMR times the crude death rate in the standard population produces the **indirectly standardized death rate** for the study population.

Table 3 presents an example. The age-specific death rates in the 1993 North Carolina standard population (column 2), after moving the decimals three places to the left, are multiplied by the 1991-95 Hertford County population in column 1 to produce the expected deaths in column 3. These expected deaths by age may be compared to the actual 1991-95 deaths by age in Hertford county, shown in column 1 of Table 1. Dividing the 1,336 total deaths observed in Hertford County during 1991-95 by the 1,187 total expected deaths results in an SMR of 1.13. This indicates that the 1991-95 death rate in Hertford County was on the whole higher than the rate in the 1993 North Carolina standard population, controlling for age. Multiplying the crude death rate in the standard population of 9.0 by 1.13 gives an indirectly standardized death rate for Hertford County of 10.2. It is usually desirable to use a standard population that is close to the same year(s) as the data for the study population, to avoid differences between the observed and expected deaths due to changing (often declining) age-specific death rates over time. This is why the 1993 (midpoint) North Carolina standard was used in this example.

Table 3
Age-Adjustment by the Indirect Method
Hertford County, North Carolina Residents
1991-1995 Combined; All Causes of Death

Age Group	1 Hertford County 1991-95 Population	2 Age-Specific Death Rates in 1993 North Carolina Standard Population (per 1,000)	3 Expected Deaths in Hertford County
0-4	8,150	2.44	20
5-14	17,109	0.25	4
15-24	16,601	0.98	16
25-34	14,872	1.53	23
35-44	16,199	2.55	41
45-54	12,381	5.03	62
55-64	10,277	12.41	128
65-74	9,370	28.48	267
75-84	5,631	63.19	356
85+	1,829	147.85	270
Total	112,419	9.0 (Crude Rate in Standard)	1,187
Standardized Mortality Ratio (SMR)			
		=	$1,336 \div 1,187$
		=	1.13
Indirectly Standardized Mortality Rate			
		=	1.13×9.0
		=	10.2

Comparison of the Direct and Indirect Methods

The direct method of adjustment is generally preferred where the numbers of deaths in the study population are large enough to produce stable age-specific death rates. A big advantage of the direct method is that the adjusted rates of a number of different study populations (e.g. all counties in North Carolina) can be directly compared to each other if they are all adjusted to the same standard population. This allows mortality comparisons assuming a constant age distribution across all of the study populations. The indirect method is often used if mortality rates by age cannot be calculated for the study population, or if the numbers of deaths in the study population are too small to produce stable age-specific death rates. A problem with the indirect method is that the adjusted rate for the study population can be compared only with the rate of the standard population. Different study populations cannot be compared to each other since the adjusted rates are not based on a common age distribution. In other words, differences in the rates may still be due to differences in age distribution, since the rates are adjusted to the age distribution of each particular study population rather than to a common standard.

Issues in the Choice of the Standard Population

An age-adjusted death rate is a hypothetical index, designed to facilitate comparisons among populations, rather than a true measure of risk. An age-adjusted death rate (by the direct method) answers the question: What would the death rate in a study population be IF that population had the same age distribution as the standard population? So in theory any population distribution can be used as the standard; it is only a set of weights applied to the age-specific death rates. The choice of the standard population will not usually have a great effect on the **relative** levels of the age-adjusted rates that are being compared. But it is important to remember that age-adjusted death rates can be compared to each other **only** if they are adjusted to the same standard.

For many years the National Center for Health Statistics has used the 1940 United States population as the standard for age-adjusting death rates. Converted to a population of one million with the same proportions at each age as in the 1940 population, this standard is sometimes referred to as the “standard million.” An advantage of consistently using this same standard population is that it promotes comparisons of age-adjusted death rates, especially in looking at trends over time from 1940 to the present. A disadvantage of using this standard is that the size of the adjusted rate is often much different from the size of the crude rate in the study population.

Take the example of heart disease mortality in North Carolina. In 1993 the crude heart disease death rate was 277.0 per 100,000 population. Age-adjusted to the 1940 United States population standard, the 1993 heart disease death rate for North Carolina was 151.4. The 1993 United States heart disease death rate, age-adjusted to the 1940 United States standard, was 145.3. This shows that the 1993 heart disease death rate in North Carolina was slightly higher than that in the United States, after adjustment for differences in age distribution. However, the North Carolina adjusted rate of 151.4 is much lower than the crude rate in 1993 of 277.0 (i.e. it is not an accurate measure of the risk of death from heart disease in 1993). This is primarily due to the following: a) the 1940 United States population is much younger than the 1993 North Carolina population, and b) heart disease death rates are much higher in the older age groups. So standardizing to a much younger population results in a much lower age-adjusted death rate. In recognition of this

problem, the National Center for Health Statistics has proposed to begin using the year 2000 United States population as the recommended standard population. This will mean that the age-adjusted death rates will generally be much more similar in size to contemporary crude death rates. However, it will also mean that time series comparisons of age-adjusted death rates will have to be re-computed using the new standard, and that rates adjusted to the 1940 standard cannot be compared to rates adjusted to the new standard.

For a number of years the State Center for Health Statistics used the current-year North Carolina population as the standard for computing adjusted rates in the annual publication *Leading Causes of Death*. This was not a problem as long as comparisons of adjusted rates were made within the current year. It did, however, preclude comparisons of adjusted rates over time since the standard population was changed every year. To address this problem, beginning in the late 1980s, the State Center for Health Statistics started using the 1980 North Carolina population as the standard for adjustment in each annual publication. This made it possible to compare adjusted death rates for different years. But as the North Carolina population has become older over time, the current-year crude death rates have generally become increasingly different in size from the adjusted death rates. In the 1996 edition of *Leading Causes of Death* we changed from computing age-race-sex-adjusted death rates to computing age-adjusted rates. (The reasons for this are discussed below.) Since the adjusted rates for 1996 forward would not be comparable to previously published rates anyway, we took this as an opportunity to update the standard population to the 1990 North Carolina population by age, which has made the crude and adjusted death rates less different in size than when the 1980 standard population was used.

Taking the example of Hertford County, the 1991-95 crude death rate was 11.9 and the age-adjusted death rate using the 1980 North Carolina population as the standard was 8.7. Using the 1990 North Carolina population as the standard, the 1991-95 age-adjusted death rate for Hertford County for all causes of death is 10.0. The main reason that this latter adjusted rate is higher is because the 1990 North Carolina population used as the standard is older than the 1980 North Carolina population.

One should be especially careful when assessing trends over time using age-adjusted death rates. It is essential that rates for different years be adjusted to the same standard population before making comparisons. Also, if the standard population is very different from the populations of the years being compared (as is often the case when using the 1940 U.S. standard), changes in the adjusted rates over time may not be an accurate reflection of the actual changes in the risk of death.

Errors of Adjusted Rates

A detailed discussion of random errors in age-adjusted death rates is beyond the scope of this paper. The reader should refer to the Statistical Primer cited in reference 1 for information on the general concepts of random errors in rates, confidence intervals, and determining if the difference between two rates is statistically significant. Using the terminology in that paper, a 95% confidence interval around a proportion can be computed as

$$p \pm 1.96 \sqrt{pq/n}$$

The $\sqrt{pq/n}$ is commonly known as the **standard error** of the proportion. In this case a death rate is treated as the proportion (p) who died during the time period of interest. If the proportion who died is small, then q (which is $1 - p$) will be very close to 1.0 and the formula becomes $\sqrt{p/n}$, where n is the population or the denominator of the proportion.

We saw from the discussion above that an age-adjusted death rate (by the direct method) is a weighted sum of the age-specific death rates. Using ten age groups, the formula for the standard error of an age-adjusted death rate is as follows:

$$\sqrt{\sum_{i=1}^{10} w_i^2 (p_i/n_i)}$$

This is the square root of the sum across the ten age groups of the square of the weight times the standard error of the age-specific death rate squared. Remember that the weight is simply the proportion of the standard population in age group i. This standard error of the age-adjusted death rate times 1.96 is the half-width of the 95% confidence interval around the age-adjusted rate.

This is a very brief discussion of a lengthy topic. For questions or assistance, contact the author.

Issues in Adjusting for Race and Gender

For many years, the death rates in the *Leading Causes of Death* publication of the State Center for Health Statistics were adjusted simultaneously for age, race, and gender. This was done for five-year death rates for specific causes of death, by county of residence. With 40 age-race-gender-specific rates being computed for the adjustment process (10 age groups x 2 race groups: white/minority x 2 gender groups), it became apparent that the data were being spread too thin. A particular problem was in the western North Carolina counties, which generally have very small minority populations, and there were also problems in other counties with a small population. Just one or two deaths in a small population group could result in a very high age-race-gender-specific rate, which would severely inflate the adjusted death rate. If this rate were applied to the appropriate age-race-gender group of the standard population, a very large number of expected deaths could result and the adjusted rate would be extremely high. On the other hand, zero deaths in several population groups may result in a very low age-race-gender-adjusted rate.

For example, in the 1995 *Leading Causes of Death* publication of the State Center for Health Statistics, Macon County was shown to have a 1991-95 age-race-adjusted death rate for female breast cancer of 64.6 (per 100,000 population) compared to the age-race-adjusted rate for North Carolina of 28.3. (Breast cancer death rates are already gender-specific and do not need to be adjusted for gender; in this case there were 20 age-race-specific death rates.) The 1980 North Carolina population was used as the standard for adjustment. Further investigation showed that this very high adjusted rate of 64.6 was due to two breast cancer deaths in a very small minority female population group (ages 55-64). When the 1991-95 breast cancer death rate was adjusted

only for age, the Macon County rate was 30.4 compared to a North Carolina age-adjusted rate of 25.6. The crude 1991-95 breast cancer death rates for Macon County and North Carolina were 56.5 and 32.1, respectively. Adjusting only for age avoids the bias due to small numbers, and the similar size of the county and state age-adjusted rates appropriately shows that the elevated crude death rate for breast cancer in Macon County was due mainly to an older population distribution in Macon County compared to North Carolina as a whole.

Age generally has a much stronger impact on mortality than race or gender, and therefore is the most important factor to adjust for. Also, there are other questions about adjusting for race. Age differences in mortality are not easily modified. Racial differences in mortality, on the other hand, are often due to factors that can be changed through public health, medical care, or socioeconomic interventions. Adjusting for race may cover up the fact that certain geographic areas, for example, have higher mortality because they have a larger percentage of minority populations (who often have higher death rates). In many cases we would want to target these areas for public health interventions and not produce statistics that adjust downward a higher level of mortality that is potentially modifiable.

For example, it was shown above that the 1991-95 age-adjusted death rate for Hertford County for all causes of death (using the 1980 North Carolina population as the standard) was 8.7 per 1,000, compared to the 1991-95 age-adjusted death rate for North Carolina (using the same standard) of 7.4. If the 1991-95 Hertford County death rate is age-race-gender-adjusted to the 1980 North Carolina population, the resulting adjusted rate is 7.7 and the comparable age-race-gender-adjusted rate for North Carolina is 7.4. This shows that the age-race-gender-specific death rates in Hertford County were similar to those in the state as a whole, but does not reveal that Hertford County had a higher overall mortality rate than the state due to a higher percentage of minorities. Minorities (primarily African Americans) are approximately 61 percent of the total population in Hertford county, compared to 24 percent for the state as a whole.

Rather than adjusting for race, a better approach would be to examine racial differences in mortality by calculating race-specific death rates, perhaps adjusted for age. Minority populations often have a younger age distribution than whites. Adjusting for age usually results in relatively higher death rates for minorities, and larger differences between whites and minorities than when comparing crude death rates. In adjusting the death rates of different race (or race-gender) groups for age, it is important to use the same standard population (or set of age-specific weights) in all cases so that the adjusted rates will be directly comparable. At the county level in North Carolina, small numbers of deaths generally preclude calculating statistically reliable death rates for minority populations other than African Americans. For this reason, we usually calculate death rates for two broad racial groups: white and all minorities combined. In North Carolina as a whole, African Americans comprise more than 90% of the minority population. (Hispanics are considered an ethnic rather than a racial group and most Hispanics are counted within the white racial group). Another problem with calculating death rates for specific minority sub-groups is the lack of accurate population estimates to use in the denominators of the death rates.

For the reasons discussed above, beginning with the 1996 *Leading Causes of Mortality* publication, we have adjusted all death rates only for age, using the 1990 North Carolina population in ten age groups as the standard.

Readers with questions or comments about this Statistical Primer may contact Paul Buescher at (919) 715-4478 or through e-mail at Paul.Buescher@ncmail.net. Further reading on the topic of adjusted rates may be found in references 2, 3, and 4.

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